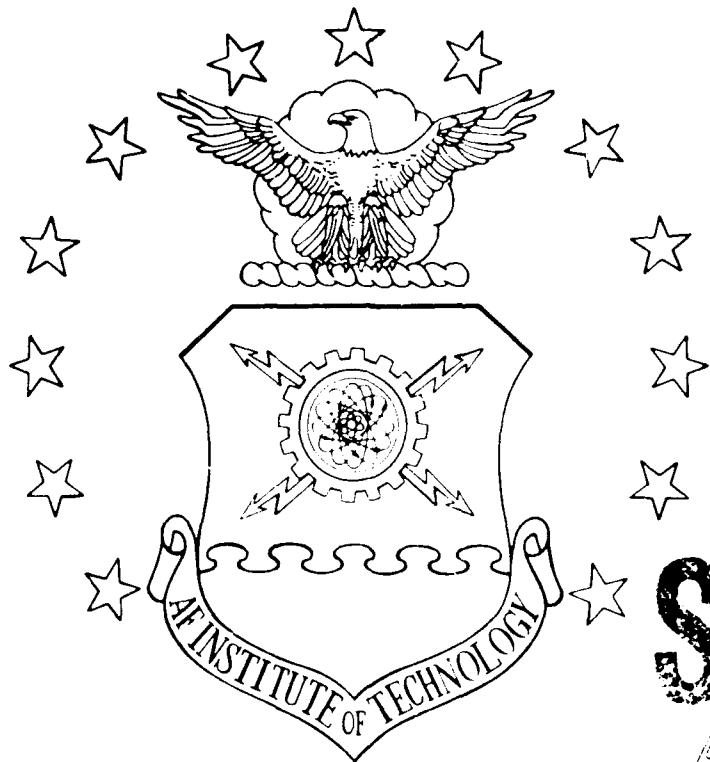
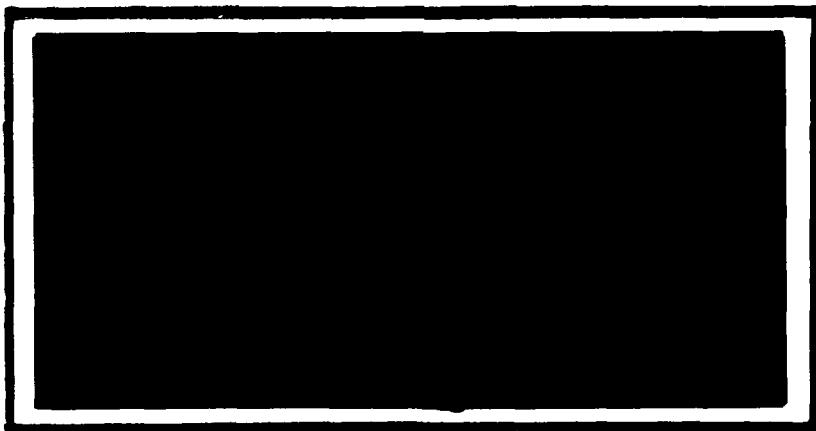


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WHETHER FOREIGN MILITARY SALES OR
DIRECT COMMERCIAL SALES:
A CASE STUDY OF THE UK E-3 AWACS

THESIS

Larry L. Brown, GS-13

AFIT/GLM/LSM/90S-6

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WHETHER FOREIGN MILITARY SALES OR
DIRECT COMMERCIAL SALES:
A CASE STUDY OF THE UK E-3 AWACS

THESIS

Presented to the Faculty of the
School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Larry L. Brown

September 1990

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Preface

The purpose of this study was twofold. The first objective was to explore the various factors that a foreign country typically considers in deciding to purchase a major weapon system from the United States through either foreign military sales (FMS) or direct commercial sale. The second objective of the study was to identify the different support problems confronting the DOD when a foreign country opts to acquire a major weapon system through a direct commercial sales arrangement.

In completing this thesis, I received a great deal of assistance from others. First, I am indebted to my thesis advisor, Dr Craig Brandt for pointing me in the right direction after a couple of abortive starts in deciding on a thesis topic. Secondly, I wish to thank the various DOD and MOD personnel interviewed for freely and openly giving of their valuable time and information. In particular, I want to express my sincere gratitude to Ms Jane Begley of the International Logistics Center (AFLC ILC) for sharing her program experience, providing ready access to program files, and reviewing this thesis for technical accuracy. Finally, I want to thank my wife Paula and our children, Jenny and Matt, for their understanding and support on those week nights and weekends when I was tied up on course and thesis work --- I owe you guys.

Larry L. Brown

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Abstract

This study explored the considerations underlying a foreign country's choice between Foreign Military Sales and commercial sale in acquiring a major weapon system and, in the process, identified various issues and problems that can confront the DOD in supporting a commercial sale.

A case study of the commercial sale of the E-3 to the United Kingdom was employed to illuminate and expand upon the proposition that there are advantages and disadvantages to each acquisition approach. The sale program was tracked from inception to the present time which is approximately six to nine months prior to delivery of first aircraft to the UK Royal Air Force.

The Defense Security Assistance Agency's brochure, "A Comparison of Direct Commercial Sales & Foreign Military Sales for the Acquisition of U.S. Defense Articles and Services" was used as a backdrop in analyzing the UK E-3 sale. Six specific considerations were evaluated including (1) the ability to negotiate and administer a contract, (2) logistics and training needs, (3) the need for DOD personnel assistance, (4) contract price, (5) delivery schedule, and (6) the need for contracting flexibility.

The study revealed that comparative price, delivery schedule, and contracting flexibility were primary

considerations in the UK's decision to acquire the E-3 through direct commercial sale. However, the study also revealed numerous drawbacks that the arrangement had for both the UK and the DOD. Finally, the study provided valuable lessons learned which can be applied to future sales of the E-3.

WHETHER FOREIGN MILITARY SALES OR
DIRECT COMMERCIAL SALES:
A CASE STUDY OF THE UK E-3 AWACS

I. Introduction

General Issue

As an instrument of foreign policy, the United States transfers billions of dollars worth of military articles and services every year to other nations.

It remains the policy of the United States to facilitate the common defense by entering into international arrangements with friendly countries which further the cooperative exchange of data, research, development, production, procurement, and logistics support. To this end the AECA (Arms Export Control Act) authorizes sales by the USG to friendly countries in the furtherance of the security objectives of the United States and in consonance with the principles of the United Nations Charter (88:Sec.1).

U.S. military export sales occur through either government-to-government foreign military sales (FMS) or purchaser-to-contractor direct commercial sales. In general, the U.S. government "has no preference as to whether a foreign country satisfies its requirements for U.S. origin defense articles through FMS or on a direct commercial basis" (29:601-1). Both acquisition methods are designed to enhance the mutual security of the United States and allied and friendly foreign governments.

In many respects, the two sales procedures have a lot in common. In both instances, U.S. government approval is needed before a weapon system can be transferred.

Additionally, both systems are subject to the provisions of the AECA which mandates similar Congressional review and arms export approval procedures. One of the biggest distinctions that can be made in the two procedures stems from the respective role played by the DOD in each. Under FMS, the DOD acts as a middleman, essentially serving as the purchasing country's executive agent in negotiating contractual agreements with U.S. firms, integrating various system support activities, and providing basic administrative services. Under direct commercial sales, the DOD plays a much more peripheral role by augmenting the direct purchaser to U.S. contractor relationship. For commercial sales involving the transfer of major weapon systems, the DOD's role is generally limited to providing required government furnished equipment/government furnished material (GFE/GFM), controlling the disclosure of classified or sensitive military information in conjunction with the Department of State, and planning for long-term logistics support following system delivery.

A foreign purchaser's decision to pursue one of the acquisition methods over the other is predicated on various considerations both peculiar to the particular country and

the specific articles being purchased. Additionally, although the U.S. government officially expresses no preference regarding which acquisition avenue is chosen, a purchaser's decision to pursue a direct commercial sales arrangement can present the DOD with a variety of complex support issues and problems. This situation commonly arises whenever the sale of a major weapon system is involved requiring substantial engineering, logistics, and systems integration support.

Specific Problem

The specific matter to be explored in this thesis is to identify the different support problems confronting the DOD when a purchaser opts to acquire a major weapon system through a direct commercial sales arrangement. For major weapon system sales, most prime contractors can provide a wide range of support services; however, some degree of DOD involvement is almost inevitable. The extent of DOD's involvement depends on numerous factors: (1) the existing capabilities of the purchaser; (2) the sensitivity of the technology being transferred; and (3) the need to provide government owned or operated assets. To maximize the potential foreign policy benefits derived by the United States in transferring a major weapon system, the DOD must ensure the system is effectively introduced into the

inventory of the purchaser's armed forces and can be operationally maintained during the system's life cycle.

Investigative Questions

To properly understand the problems confronting the DOD in effectively supporting a major weapon system transferred through a direct commercial sales arrangement, the reader must first recognize the various factors considered by the purchaser in selecting a direct commercial sales arrangement versus FMS. An understanding of this issue will provide insight into the purchaser's perceptions of its own capabilities, the relative strengths and weaknesses of the two system acquisition methods, and the anticipated support role to be played by the DOD. In the process, the underpinnings of DOD's support function and associated problems can be identified.

The acquisition of the E-3 Airborne Warning and Control System (AWACS) by the United Kingdom (UK) through direct commercial sale will be used as a backdrop in exploring the myriad of considerations and issues involved. The UK E-3 sale was chosen for evaluation because of the procedural and policy questions engendered, the degree of DOD involvement entailed, and the range of support issues raised.

The specific investigative questions posed are:

1. What factors were considered by the UK in deciding whether to purchase the E-3 through direct commercial sale versus acquiring the system through FMS?
2. From the UK's standpoint, what were the perceived advantages and disadvantages of direct commercial sales versus FMS?
3. What policy issues arose and what problems are confronted by the DOD in supporting the transfer of E-3 system through direct commercial sale?

The research into and analysis of these investigative questions should yield an overall insight into the comparative benefits and drawbacks of each acquisition method.

Scope of Research

The scope of this thesis is restricted to exploring the support issues involved in transferring major aircraft weapon systems under the military export sales provisions of the United States Security Assistance Program (SAP). The investigation does not address the transfer of less than major systems (for example, small arms), the transfer of weapon systems through grant (or military assistance) procedures, nor other elements of the SAP such as International Education and Training (IMET), United Nations

Peacekeeping Operations (PKO), Economic Support Fund (ESF), etc. Additionally, to amplify the various issues that can arise for the DOD in supporting aircraft system transferred through direct commercial sale, the investigation focuses on the acquisition of the E-3 Airborne Warning and Control System (AWACS) by the United Kingdom (UK). The technical sophistication and sensitivity of the E-3 AWACS combined with complex government-to-government and contractor-to-government relationships involved provide an excellent example of the myriad of support issues and problems that can occur in supporting a direct commercial sale.

Definitions

Please refer to the Glossary of Selected Terms provided at Appendix A. Unless otherwise noted, the definitions have been extracted from the ninth edition of the Management of Security Assistance, a text developed for educational purposes by the Defense Institute of Security Assistance Management, Wright-Patterson Air Force Base, Ohio. A list of the most commonly used acronyms used in this thesis is provided at Appendix B.

Plan of Presentation

Chapter I: Introduction. The first chapter provides an overview of the general issues involved in a purchaser's decision to acquire arms through either FMS or direct

commercial sales. The chapter also presents the specific problem being explored, enumerates the related investigative questions to be answered, delimits the scope of research, and identifies the various sources of data relied upon in conducting the research.

Chapter II: Methodology. This chapter describes the research methods employed in conducting this thesis project. The methodology provides the rationale for the selected case study approach and describes the steps followed in the literature research and supplemental interview processes.

Chapter III: Background. The third chapter first provides a broad overview of U.S. arms transfers since World War II while addressing the growth of military export sales as a portion of the total U.S. arms transfer program. The chapter continues by tracing the events leading up to and immediately following the United Kingdom's decision to purchase the E-3 AWACS through a direct commercial sale arrangement with Boeing Aerospace, Inc. Finally, the chapter concludes by reviewing the general issues involved in the UK's decision to purchase the E-3 through direct commercial sales versus acquiring the system through the U.S. government's FMS procedures.

Chapter IV: Analysis. In this chapter, various elements of the UK E-3 AWACS sale are analyzed against the investigative research questions posed in Chapter I.

Chapter V: Findings. This chapter measures the results of the UK E-3 sale against the basic considerations involved in choosing direct commercial sale as the preferred method of weapon system acquisition.

Chapter VI: Discussion and Recommendations. This concluding chapter summarizes the major findings of the research and discusses any conclusions drawn.

II. Methodology

Research Approach

To address the research problem and to explore the investigative questions, the case study method has been employed. Specifically, the E-3 AWACS sale to the United Kingdom was analyzed. Emphasis was placed on first evaluating the considerations underlying the United Kingdom's decision to acquire the E-3 through direct commercial sales and then identifying the various support issues confronted by the Department of Defense.

The E-3 AWACS sale to the UK was chosen for analysis because of the following factors: (1) the complexity of the organizational interrelationships; (2) the tremendous investment in time, manpower, and financial resources involved in acquiring, operating and maintaining AWACS aircraft; (3) the sensitivity of the data, technology and equipment involved; and, (4) the extensive nature of commercial offset arrangements. It must be noted that on the whole, the transfer of highly sophisticated aircraft weapon systems through direct commercial sales has been the exception rather than the rule. Besides the E-3 sale to France and the United Kingdom, however, recent notable exceptions involving the sale of sophisticated aircraft

through direct commercial export include a F-18 sale to Canada (137 aircraft) and a F-16 sale to Greece (40 aircraft).

The research proceeded into stages. A literature search was initially conducted to determine:

1. The various factors considered by the United Kingdom in first selecting the E-3 aircraft to meet its airborne early warning requirements and then choosing a direct commercial sales arrangement as the means of transfer.
2. The U.S. policy governing transfers through FMS versus direct commercial sale.
3. The specific problems presented to the DOD in supporting the delivery and operation of an aircraft system acquired through direct commercial sale.

The literature search was essentially divided into parts. One segment consisted of a review of pertinent periodical literature including various aerospace publications/journals such as Aviation Week and Space Technology. The second part of the literature search relied heavily on original program documents including official minutes of various program meetings, internal USAF correspondence and briefings, contractual documents, memoranda of understanding, etc.

Information drawn from the literature search formed the backdrop for the second stage of the research. The next step taken was a survey of U.S. and UK personnel assigned with varying degrees of responsibility for administering and managing the UK E-3 program. Whenever possible, face-to-face interviews were conducted. When this type of interview technique was not practical, a combination of telephone and mail interviews was relied upon. A flexible survey technique was used that addressed as a minimum the following areas:

1. Interviewee's background and specific role in and length of association with the UK E-3 program.
2. Interviewee's comments and views on the study research questions as they related to his/her particular area of program involvement.
3. Interviewee's additional comments concerning any other aspects of the UK E-3 program that fell outside of the specific research questions being pursued. (Note: Based on the interviewee's particular position and experience background, supplemental questions were added to obtain a more in-depth understanding of various aspects of the program).

Interviews were conducted with individuals in the following activities:

1. International Programs Division, Headquarters USAF (AF/PRI).
2. Defense Security Assistance Agency.
3. Defense Institute of Security Assistance Management.
4. International Logistics Center, Air Force Logistics Command.
5. E-3 System Program Management Office, Oklahoma City Air Logistics Center.
6. E-3 System Program Management Office, Electronics Systems Division.
7. United Kingdom E-3 Foreign Liaison Office attached to the E-3 System Program Management Office, Oklahoma Air Logistics Center.

Literature Review

Foreign Military Sales (FMS). Under FMS procedures, the DOD makes purchases for the foreign buyer through its established contracting network. The buyer/seller relationship is prescribed by a DD Form 1513, Letter of Offer and Acceptance (LOA) which is prepared by the DOD, signed by the foreign buyer and contains the terms and conditions pertaining to the furnishing of defense articles and services. Other than setting requirement needs and

specifications, the foreign buyer is not involved in contract negotiations. Unless the foreign buyer specifically requests a particular source and provides substantiating justification, the DOD has sole authority to select the contractor source in satisfying the customer's needs.

The LOA price presented to the foreign buyer is a best estimate based on price quotes received from prospective contractors or derived from other recent, similar sales. The estimated price includes not only the base price of the article or service being procured but also other authorized DOD charges. These additive charges are intended to fully recoup the DOD's cost of doing business on behalf of the foreign buyer. Additive charges recover costs for such activities as material handling, contract administration, administrative overhead, logistics support, and nonrecurring research and development. Charges are generally applied on a percentage or pro-rata basis dependent to some degree on the base price of the articles and services being furnished.

Direct Commercial Sales. Under direct commercial sales arrangements, the foreign buyer negotiates contracts directly with prospective contractors. Contracts (especially those involving weapon systems) tend to be firm fixed-price in nature with specified delivery dates. The cost of commercial contracts include the base price of the

articles and services being provided with an additive charge for general and administrative (G&A) costs applied.

Although the additive G&A charge does not directly correlate with the administrative charge applied by the DOD in FMS agreements, the two charges are comparable in scope. The main difference is that the DOD breaks out its additive charges whereas commercial contractors tend to list them as one lump sum entity.

FMS Versus Direct Commercial Sales. "The choice of either FMS or direct commercial sales is driven by the special circumstances of the foreign purchaser, rather than a substantive differences in the two systems" (27:11). During the mid-1980s, based on questions raised by prospective foreign buyers and concerns expressed by the U.S. defense industry, the Defense Security Assistance Agency (DSAA) developed an information brochure entitled "A Comparison of Direct Commercial Sales & Foreign Military Sales for the Acquisition of U.S. Defense Articles and Services." As an 1989 introductory letter states, the brochure is designed to "present objective background information, pertinent considerations, and clarification of misconceptions which have been encountered regarding the FMS and direct commercial processes." Drawing on the accumulated experiences of the DOD, U.S. contractors and foreign buyers, the brochure identifies the perceived

advantages and disadvantages of each acquisition method depending on the particular circumstances of the country and articles and services involved. Please refer to Table 2-1 on the next page for a summary of the comparative advantages of each acquisition method as enumerated in the DSAA brochure.

Table 1
COMPARATIVE ADVANTAGES

<u>FMS</u>	<u>Direct Commercial Sale</u>
1. Total package approach based on U.S. military experience.	1. More capability to tailor package to unique country needs.
2. USG uses established procurement procedures and contracting network.	2. Direct relationship allows country to negotiate cost and contract terms.
3. For items common to the DOD, proven logistics support is available.	3. For items not common to the DOD, contractor may be sole source for logistics support.
4. Use of competitive contracting procedures can reduce cost to customer.	4. Direct negotiations with contractor can result in quicker deliveries.
5. The probability for equipment standardization/ interoperability is enhanced.	5. All equipment will come direct from production line, none from DOD stocks.
6. Purchaser pays only actual DOD costs with contractor profits controlled by regulation.	6. Can negotiate a firm fixed price contract with contractor penalties.
7. Quality assurance is provided by DOD personnel.	7. Quality assurance can be purchased or provided by country personnel.
8. The DOD is not a guarantor of offset arrangements negotiated.	8. Purchaser can include offset provisions in a single contract.

Program Documentation. Considering time and travel constraints, official program documents and correspondence were relied upon to the maximum extent possible to attain insight in the conduct of the UK E-3 program and the various issues and support concerns involved. The list provided below is not exhaustive of the total program documentation reviewed but is indicative of the bulk of the research material. Specific documentation included:

1. UK MOD - Boeing contract.
2. UK MOD - DSAA Memorandum of Understanding.
3. Minutes of General Officer Reviews.
4. Minutes of Quarterly Program Reviews.
5. Letters of Offer and Acceptance (LOA).
6. Internal U.S. Air Force letters, messages, and memos.
7. Letters between the UK MOD and Boeing.

The program documentation provided an excellent audit trail of the major issues that arose during the course of the UK E-3 program, the positions taken by the participating parties, the problems that occurred, corrective management actions taken, and potential difficulties looming on the horizon. This portion of the literature review served as an informational backdrop for the next stage of the research, the interview process.

Interview Results

Interviews were conducted with UK MOD and DOD personnel assigned to various organizations with responsibility for managing different aspects of the UK E-3 program. These interviews were designed to "breathe life" into the myriad of documents reviewed during the literature review. The objective was to either validate or contradict preliminary conclusions reached during documentation review or indicate the direction in which additional research should be conducted. Generally speaking, the interviews either confirmed tentative findings or clarified areas of uncertainty.

III. Background

General

The United States arms transfer policy has undergone numerous changes over the past 50 years. During World War II, the United States became the "Arsenal of Democracy" by covering the military production shortfalls experienced by the allied nations. For a period following the war, the U.S. was generally viewed as being the lone superpower in the world. The industrial base of Western Europe and Japan had been ravaged by the conflict and the Soviet Union had not yet attained atomic power status.

During the late 1940s and continuing through the 1950s, the Truman and Eisenhower administrations focused their foreign policy attention on containing the spread of Soviet Union sponsored communism through the concept of collective security (42:6). As part of this policy, military arms excess to U.S. defense needs were transferred through nonreimbursable grants to allied or friendly nations that either bordered or were located strategically near communist bloc countries. Principle arms recipients included Greece, Turkey, South Korea, and Western Europe. To further strengthen its collective security efforts, the United States entered into numerous mutual defense arrangements such as the North Atlantic Treaty Organization (NATO).

By the early 1960s, the non-communist bloc industrialized countries had recovered economically to the extent that the Kennedy administration believed them capable of sharing the cost burden of collective security. The Foreign Assistance Act of 1961 was enacted as a result. This legislation laid the groundwork for the transition of arms transfers from a grant to a sales basis (72:6).

With Western Europe's economic recovery, the focus of Soviet and American foreign policy competition shifted to the Third World (42:21). Consequently, beginning in the mid-1960s and continuing to the present time, an increasing percentage of U.S. arms have been flowing to Third World nations. First, there was the military entanglement in Vietnam where huge quantities of U.S. arms were transferred on a grant basis. Secondly, massive support was provided to Israel to ensure its continued existence and security. Third, various oil rich nations such as Iran and Saudi Arabia embarked on major arms purchase programs using funds derived from oil revenues.

The Vietnam experience generated public questions regarding whether the U.S. should and, perhaps more importantly, could continue to serve as the world's policeman, a role it had played with varying degrees of success since the end of World War II. When it came to office in 1969, the Nixon Administration emphasized the need

for other nations to assume greater responsibility in providing for their own defense. Security assistance became the key instrument for strengthening the military capabilities of our allies and friends. In what became known as the Nixon Doctrine, security assistance was used to "bolster the military power of key regional states to the extent that those states were willing and able to preserve regional peace without direct U.S. military involvement." (42:23)

To enhance the ability of allies and friends to deter or defeat aggression, the U.S. began transferring more sophisticated weaponry. The shift away from providing older, often obsolete (at least according to U.S. military standards), military arms began after the 1967 Arab-Israeli War when the U.S. replaced Israeli losses with technologically advanced weapon systems to offset Arab numerical advantages. The trend toward the export of higher quality arms was accelerated by the subsequent 1973 Arab-Israeli War and the accompanying Arab oil embargo (42:22).

The adverse economic impact created by the Arab oil embargo revealed the dangerous degree to which the health of the Western democracies' industry were dependent on Middle East energy resources. Assuring the continued, uninterrupted flow of oil from the Persian Gulf region, therefore, became a vital interest to the U.S. (71:143)

Seeing an opportunity to increase its influence in the Middle East and Persian Gulf region while simultaneously blunting Soviet leverage in the area and offsetting rising oil import costs, the United States established multi-billion dollar arms sales programs first with Iran and later with Saudi Arabia. Both countries were viewed by the U.S. as potential, stabilizing influences among their more radical Arab neighbors and the best candidates to fill a power vacuum created by an earlier British withdrawal from the region (71:145,186). As the countries' oil revenues rose, the level of U.S. military exports increased accordingly including the transfer of front-line weapon systems which were just then being introduced into the U.S. military inventory (for example, F-14 and F-15 aircraft).

Aroused by negative reaction to the Vietnam conflict and what it perceived to be an uncontrolled race to arm the world, the U.S. Congress began to play a more assertive role in the shaping and conduct of U.S. foreign policy (42:70). When Turkey invaded Cyprus in 1974, the Congress imposed an arms embargo on Turkey. Following this action, a requirement was included in the FY75 foreign aid bill mandating Administration notification of the Congress of any planned government-to-government sales totaling over \$25 million in value. Congressional concern about the U.S. role in the world arms trade eventually led to the passage of the

International Security Assistance and Arms Export Control Act (AECA) of 1976 which imposed tighter controls over arms exports and changed the balance of power between the Executive and Legislative Branches in the conduct of foreign policy.

Although the AECA provided Congress with a stronger voice in arms transfer decisions, it did not significantly alter the volume of arms sales. The Carter Administration's official policy was that arms transfers should be used only as an exceptional element of U.S. foreign policy. To restrain arms proliferation, the U.S. would not be the first nation to introduce high-technology weapons into a region (71:52).

While the flow of U.S. arms was initially slowed under this policy, the inertia of world events soon overcame President Carter's basic philosophical concern about undesirable side effects of the arms transfer business. To cement the 1979 Camp David peace accords between Egypt and Israel, the U.S. agreed to upgrade each country's military capabilities by transferring billions of dollars worth of advanced weaponry (for example, F-16 aircraft). Later in the year, the fall of the Shah of Iran revealed the precarious nature of U.S. interests in the Persian Gulf. To offset Iran's loss, expanded arms sales were proposed for Saudi Arabia.

When the Reagan Administration came to office, arms transfers were seen as an indispensable component of U.S. foreign policy, not as a policy instrument of last resort (71:62). Arms sales were viewed favorably as long as they were not contrary to U.S. interests with economic considerations assuming greater importance in arms transfer decisions (37; 76; 89). Increased sales improved U.S. trade balances, and strengthened the U.S. defense industry by enlarging the industrial base, increasing employment, providing economies of scale for U.S. military equipment, and offsetting the cost of research and development investment. Supported by a more favorable climate, the value of U.S. arms sales agreements rose dramatically eventually peaking in FY82 at around \$21 billion .

The expansion of arms sales was marked by a dramatic rise in the percentage of total sales occurring through direct commercial arrangements. Until the mid-1970s, dollar ceilings were imposed on the size of military arms sales agreements that could be negotiated on direct commercial basis. Consequently, virtually all sales involving major defense equipment were conducted under FMS procedures. Today there are few limitations placed on the amount, type, or cost of arms that can be provided through either direct commercial sales or FMS. When special circumstances warrant under Section 38(a)(3) of the AECA, however, the President

(as delegated to the Director of the Defense Security Assistance Agency) can direct particular defense articles or services to be sold under FMS in lieu of commercial channels. This authority is rarely used but, as will be noted later, is of particular interest to the case study at hand.

Figure 1 tracks the trend in U.S. arms sales in terms of foreign military sales versus direct commercial sales. The data were extracted from Foreign Military Sales, Foreign Military Construction Sales and Military Assistance Facts, As of September 1989 issued by the DSAA. To place the data on a common year baseline, the value of delivered military articles and services covering like time periods was compared. The value of new FMS agreements signed in any given year was not used for comparison purposes because actual deliveries normally occur production lead time after the date of purchaser acceptance. (Note: As an example, the bulk of deliveries for an aircraft sale may not occur until 36 to 48 months after purchaser signature of the FMS letter of offer and acceptance.) Additionally, the value of commercial exports is determined only upon clearance through the U.S. Customs Service at U.S. ports of exit.

As a percentage of total military export sales, direct commercial sales has shown a marked increase through the 1980s achieving an almost equal level with FMS in FY88

before receding in FY89. Please see Figure 2. As more countries improve their technology bases, technical skills, contracting capabilities, etc., it is not unreasonable to assume that failing any significant legislative changes, direct commercial sales will continue to represent a major portion of the total U.S. military export business.

The following definitions are provided for your information in understanding the basis for Figures 1 and 2 (28:iii-iv).

Foreign Military Sales Agreements - Total dollar value of defense articles and defense services purchased with cash, credit, and MAP Merger Funds by a foreign government or international organization in any fiscal year.

Foreign Military Sales Deliveries - Total dollar value of defense articles and defense services delivered to a foreign government or international organization in any fiscal year. After implementing an FMS agreement, the responsible military department directs release of materiel from stocks or procurement or provision of services or training. As execution progresses, the military department reports accrued expenditures and physical deliveries within 30 days of date of shipment or performance.

Commercial Exports - The total dollar value of deliveries made against purchases of munitions-controlled items by foreign governments directly from U.S.

manufacturers. The data are compiled by the Center for Defense Trade (formerly the Office of Munitions Control), Bureau of Politico-Military Affairs, Department of State, from shippers' export documents and completed licenses returned from ports of exit by the U.S. Customs Service.

FMS

COMM

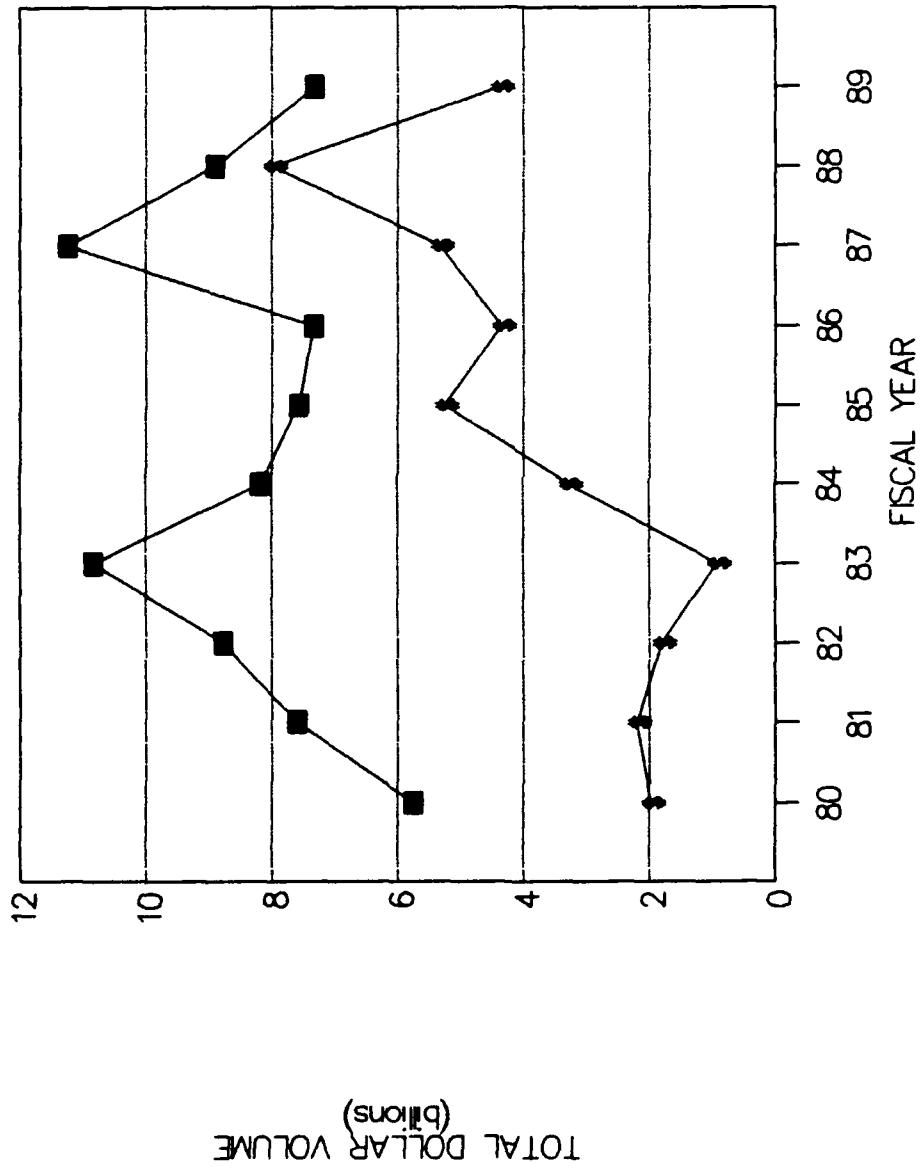


Figure 1. US Military Export Sales Deliveries:
FMS Versus Commercial (28:16-17, 44-45)

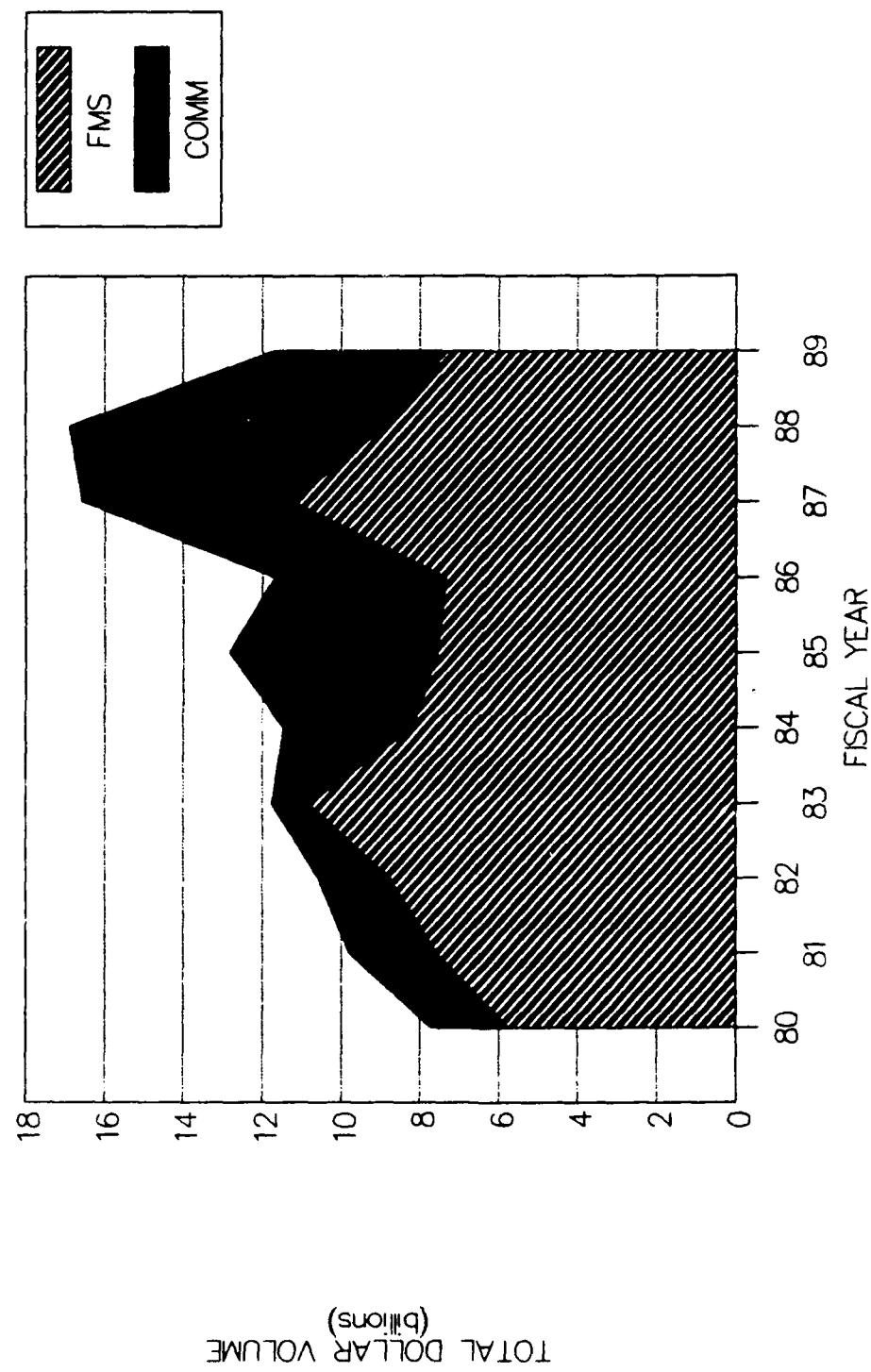


Figure 2. US Military Export Sales Deliveries:
FMS and Commercial (28:16-17, 44-45)

The E-3 AWACS Program

Boeing's E-3 "Sentry" aircraft is an airborne radar surveillance and control system. Based on Boeing's 707-320B commercial airliner, the E-3 incorporates sophisticated avionics and electronics gear yielding an over-the-horizon capability to identify and track other airborne vehicles regardless of terrain or weather conditions and to direct interceptor aircraft as needed. Today, 57 E-3 aircraft are in service world-wide (34 - United States; 18 - NATO; 5 - Saudi Arabia) with another 11 scheduled for delivery to France and the United Kingdom. Additionally, interest in the E-3 has been expressed by several other countries (e.g., Italy, Japan, and Korea) but no agreements have yet been signed.

The U.S. Requirement. The need for a long-range airborne radar platform was conceived by the USAF during the 1960s with the primary objective being to extend the "eyes" of ground based radar systems. As initially perceived, the primary role for the airborne warning and control system (AWACS) was to be strategic in nature. Considering Soviet advances in strategic missile and bomber capability during the late 1950s and the early 1960s, the U.S. was interested in extending its threat detection boundaries, thereby increasing the response time available to exercise

appropriate countermeasures should the need arise. With improvements in the accuracy and reliability of satellite surveillance systems over the years, however, the mission of E-3 aircraft today has evolved to an equal mix of strategic and tactical deployment.

Budgetary restraints combined with competing DOD priorities stemming from the Vietnam War delayed funding of a long-range airborne radar system until the latter part of the 1960s. In July 1970, Boeing was selected over McDonnell-Douglas to be the prime contractor and system integrator for an AWACS aircraft. The basic contract negotiated by the USAF divided the program into three phases. In phase one, Boeing tested two competing radar systems supplied by Hughes Aircraft and Westinghouse. When exercised, phases two and three provided for full scale development and production respectively. The original USAF requirement estimate called for 42 aircraft. The bulk of the proposed aircraft were targeted for the Air Defense Command reflecting the system's perceived strategic importance at the time.

Although Boeing's 707-320B commercial aircraft was a proven performer, numerous modifications were required to meet the AWACS configuration including redesign of the aft fuselage section and environmental and electrical subsystems, modification of the hydraulic system, the

addition of a yaw damper to the flight control system, and installation of struts, control system, and housing for the radar's rotodome. Testing of the competing Hughes and Westinghouse radar systems proceeded on schedule with Westinghouse eventually being chosen as the winner. For Westinghouse, the selection was a boon for business because the company had recently lost out to Hughes in competition to supply the radar system for the F-15 aircraft.

Following the successful testing of the airborne radar capabilities, the USAF exercised phase two of the contract governing full-scale development of the aircraft system. Development efforts proceeded on schedule with the USAF requirement being scaled back to 36 aircraft. During the spring of 1973, an E-3 prototype was tested in Western Europe to determine its capability in dense air traffic environments. While the test results were generally satisfactory, concerns surfaced regarding the system's susceptibility to electronic counter-measures (ECM).

Issues surrounding the system's ECM survivability and an apparent change in the mission role projected for the E-3 fueled a spirited debate between DOD officials and Congressional critics. First, a shift in USAF emphasis regarding the E-3 AWACS role away from strategic warning to a more world-wide, general-purpose tactical aircraft raised Congressional questions whether the USAF was shopping for an

AWACS mission in the face of declining funding for the U.S. strategic air defense force (21:17). Secondly, with the AWACS mission moving to a more tactical role, the most likely scenario for system employment was in support of NATO defense requirements in Central Europe where the air traffic and electronic emission environments are among the densest on the globe. The USAF claimed that earlier ECM survivability concerns had been successfully addressed but critics remained unconvinced. Third, the direct cost of the aircraft combined with offshoot requirements to upgrade interfacing ground radar and communication systems guaranteed intense Congressional interest and scrutiny. Under a full-scale production contract, the per aircraft cost would easily top \$100 million. In general, critics found the E-3 to be too expensive with a mission it could not satisfactorily perform. Various alternatives were proposed including the equipping of C-130 aircraft with a search radar (leaving command and control functions to existing ground facilities) and the modification of surplus Boeing 707 commercial transports to AWACS configuration.

Satisfied that the E-3 had successfully met all performance milestones, the DOD included a requirement in the FY75 President's Budget to procure 12 production aircraft. The request met with immediate, harsh treatment on Capitol Hill. When combined with a similar funding

request for the B-1 bomber, the E-3 proposal stimulated considerable Congressional debate whether production funding should be authorized before operational capability had been clearly established during prototype testing. Concerns about past DOD cost overruns, performance deficiencies, and escalating price estimates for on-going programs prompted many Congressman to advocate a "fly-before-buy" approach to weapon systems procurement. Others wanted to defer production approval until a NATO order was in hand. Congressional opposition was supported by a March 1974 General Accounting Office report which although supportive of the USAF's requirement for an AWACS capability, recommended deferral of production approval until the end of development testing scheduled for the latter part of the year.

From the DOD's standpoint, Congressional approval for the FY75 production go-ahead was essential to maintaining program schedule stability and minimizing production costs. A delay in production approval would create breaks in manufacturing and assembly activities with a loss or shift of contractor personnel to other projects. Looming behind DOD's considerations was Boeing's plan to close the 707 production line in late 1974. (Note: Boeing later extended the planned closure date to 1977.) The expected outcome of

a delay in receiving production approval was drastically increased production costs perhaps beyond an affordable level.

During the spring and summer, the Administration waged a running battle with Congress. The House initially halved the DOD request reducing the number of aircraft approved for FY75 funding to six while the Senate supported the full requirement. A House-Senate conference later resolved the issue in DOD's favor. DOD assurances that authorized funds would not be obligated until development testing was completed probably sealed Congressional support. In April 1975, the DOD implemented phase three of the contract initiating production activities.

The NATO Decision. In Europe, the NATO countries had been watching the events unfolding in the U.S. with great interest. While alliance nations recognized the need for an AWACS capability to upgrade the command and control of NATO's air defense forces as a deterrent to Soviet aggression, they were not prepared to commit to the E-3 until the USAF did. Even at that, such a commitment would carry a sizable price tag in the form of concessions and offsets from the U.S.

To promote greater standardization and interoperability among NATO forces and in recognition of legitimate economic and political interests of Alliance members, U.S.

administrations in the mid-1970s emphasized more of a two-way street in arms purchases with NATO countries. For its part, Boeing offered NATO essentially three proposals including an all-U.S. production which became the baseline bid; an all-U.S. production using a GE/Snecma CFM56 engine; and, industrial collaboration. It soon became readily apparent to Boeing that the only viable option was collaboration. Anticipating the NATO countries' demand for a work share in program production as a direct offset for an E-3 purchase, Boeing began identifying items and tasks that could be procured abroad and began evaluating potential industry sources. Based on the initial review, Boeing developed a tentative bidder's list and solicited companies to submit bid packages. Eventually 690 bid packages were received involving over 150 companies in 12 countries. The potential amount of direct offset work for Europe was estimated to be around \$500 million.

NATO reacted in a lukewarm fashion to Boeing's overtures; 1975 and 1976 passed with no definitive agreement or decisions reached among the member countries. Alliance concerns about cost sharing, budgetary difficulties, employment impacts, and technology transfer bogged down negotiations. Britain was developing its own AWACS capability with the Nimrod aircraft and was concerned about losing jobs. British participation would require offset

work as compensation (e.g., co-producing the McDonnell-Douglas AV-8B Harriers). Like Britain, West Germany required offset arrangements to guarantee its participation (e.g., U.S. army selection of the Leopard 2 as its main battle tank). To differing degrees, the other Alliance members had similar interests; none were interested in acquiring the E-3 off-the-shelf from the U.S. (23:17).

In the spring of 1977, Britain pulled out of the NATO E-3 deliberations. Development work on the Nimrod program had progressed to a critical go - no go point. Repeated NATO delays in reaching agreement on a cost sharing arrangement agreeable to all parties finally forced Britain's hand. Additionally, the British were disappointed by Boeing's marketing failure to couple the proposed E-3 sale with a joint civilian program venture (e.g., 757/767 commercial airliners) which would bolster Britain's commercial aerospace business (18:15).

The remaining months of 1977 saw the Alliance striving to iron out the cost-sharing entanglement. In an effort to ease budgetary impacts on individual members which were exacerbated by Britain's withdrawal, France was offered a chance to put GE/Snecma CFM56 turbofan engines on the E-3 in return for its participation and financial contribution; the French declined. To help alleviate the financial burden for participating countries, the U.S. agreed to increase its

share of the total program's cost. Finally by December, NATO had resolved its internal differences and had reached agreement to develop a standard version of the E-3 for both the USAF and NATO. Program cost sharing percentages were as follows: United States - 42%, West Germany - 31%, Canada - 9%, Italy - 5%, and others - 13%.

With an agreement in hand, the NATO members next had to acquire sufficient budgetary authorizations from their individual legislatures to satisfy the program's financial commitments. As the largest European contributor (i.e., \$500 million), West Germany required extensive offset promises to assure Bundestag support. In response, the U.S. government in conjunction with Boeing agreed to: (1) provide \$250 million worth of in-country work for E-3 avionics, electronics and installation and check out; (2) purchase \$80 - \$90 million worth of German military vehicles and trucks for U.S. forces stationed in Germany; (3) provide \$80 - \$90 million for German avionics companies to improve/modify U.S. communications equipment and facilities in West Germany; and, (4) seriously consider West Germany as the site for the E-3 main operating base (projected economic impact of \$50 - \$65 million) (36:17). West Germany viewed the agreement as providing a technological springboard to its aerospace industry in "narrowing the U.S. lead in avionics, electronics and other systems" (40:18).

Comparable but much less extensive arrangements were made with the other contributing members.

The deal struck with the Alliance was not without its critics in the U.S. In a 1980 report, the GAO described what it considered to be extensive concessions and compensation programs made noting in particular the refusal by some Alliance members to share program cost increases and the U.S. waiver of approximately \$300 million in recoupment charges for research and development costs. The end result of these actions brought the total U.S. financial contribution to around \$1 billion.

For Boeing, the NATO deal represented a sharp departure from traditional subcontractor/supplier relationships. Extensive overseas sourcing for the E-3 was required to satisfy offset and work share requirements. Additionally, for the first time, Boeing subcontracted installation and checkout responsibility of a program for which it served as prime contractor (33:75).

Delivery of the NATO aircraft began in December 1981 with subsequent deliveries interspersed with USAF deliveries. The last of the 18 NATO aircraft were delivered in 1985.

Iran and Saudi Arabia. Concurrent with NATO's decision to procure the E-3, other countries, most notably Iran and Saudi Arabia, began expressing interest in acquiring the

system. The U.S. approved the transfer of the E-3 to Iran on a straight cash basis but later withdrew the offer when the Shah was overthrown. The Saudi request raised some of the harshest criticism of the Reagan administration's arms transfer policy. Notwithstanding the Saudi's pledge to restrict E-3 operations to well within its national borders and DOD assurances that operational capabilities would be restricted, critics were alarmed by the increased threat posed to Israeli security. Still other were disappointed by Saudi Arabia's unwillingness to play a more assertive role in the Middle East peace process and expressed their frustration by withholding support from the transfer request. After considerable public haggling and political in-fighting, the Administration was able to push the sale through Congress. All five E-3 aircraft with supporting KE-3 tankers have now been delivered.

The United Kingdom Revisited. As noted earlier, Britain had backed out of NATO consideration of the E-3 in 1977 opting instead to pursue independent development of its Nimrod airborne early warning system. By the end of 1985, however, British defense officials having become concerned about the Nimrod's escalating costs, schedule delays and failure to meet RAF specifications, decided to seek competitive bids from various AWACS manufacturers (15:26). By July 1986, seven companies including the Nimrod's prime

contractor, GEC Avionics, had submitted bids. American competitors included Boeing (E-3), Grumman (E-2C), and Lockheed (P-3) (75:22).

The UK AWACS Decision. During the remainder of 1986, the British reviewed the bids and evaluated the various proposed aircraft against operational requirements. By the fall, the competition had been reduced to two companies, Boeing and GEC Avionics. Perhaps recognizing the deficiencies in its previous marketing approach to Britain, Boeing in conjunction with its primary partners, Westinghouse and GE/Snecma, revised its bid by first offering a 100 percent work offset to British industry and then sweetening it further in November by raising the ante to a 130 percent offset level. The offer was "the highest ever made by Boeing in an international competition" (9:24). Approximately 10 percent of the total offset value would be directly related to the E-3 aircraft while the remaining 90 percent would be satisfied through other advanced technology programs. Boeing estimated that more than 50,000 manyears of employment would be provided over an eight-year period with British industry realizing about \$2 billion worth of business (16:24).

Citing the Nimrod's inability to meet the full specifications set by the RAF, British officials in December selected the E-3 and canceled the Nimrod program with GEC

Avionics where over \$1.3 billion in development funds had already been spent (19:22). The decision was politically sensitive. Not only was the acquisition cost for the seven E-3 aircraft ordered significantly higher than completing work on the Nimrod (approximately \$400 million), but considerable employee displacement at GEC Avionics was anticipated. Additionally, there were fears that British industry might end up being excluded from the future world market for airborne early warning aircraft. As counter-balancing arguments, British and Boeing officials pointed to projected lower life-cycle operating costs for the E-3 drawn from USAF and NATO experience and the anticipated expansion of employment at other British avionics and electronics firms. The indirect offset in other high-technology programs managed by Boeing promised, in particular, to keep British industry on the cutting edge of advances in aerospace technology.

In February 1987, Britain formally signed the E-3 acquisition contract with Boeing. Consummation of the sale had been delayed while a U.S.-British disagreement over export controls on AWACS technology was hammered out. Initially, the U.S. insisted that any subsequent British export of high-tech AWACS components would be subject to U.S. Commerce Department licensing under the provisions of the Arms Export Control Act (AECA). Britain in turn viewed

the U.S. position as an unwarranted infringement on British sovereignty. To resolve the dispute, a memorandum of understanding (MOU) was signed between the two countries which outlined respective responsibilities and support arrangements between the parties and from the British viewpoint, provided that "control of reexport from the United Kingdom will be enforced exclusively by the United Kingdom government" (14:263). Observers believed the question of export control to be largely symbolic in nature and, therefore, moot because Britain and the U.S. have similar export control regulations on the transfer of high-technology military equipment (14:263).

France. Also in February, France, following the British lead, selected the E-3 in lieu of the Nimrod which it had been evaluating. The French sale involved four aircraft and provided essentially the same 130 percent work offset agreement with Boeing. Approximately 60 percent of the total offset value would be satisfied by GE/Snecma providing CFM56 engines for installation on the British and French E-3 aircraft as well as the E-3 and KE-3 aircraft previously ordered by Saudi Arabia. The remaining 40 percent of the offset would be met through non-AWACS related aerospace program contracts (35:27). (Note: The French had seriously considered purchasing the E-3 in 1984 when it

sought FMS and contractor proposals but opted instead to defer a purchase decision until later).

Current UK/ROF Program Status. Today, the British and French programs are on schedule although a 1989 employee strike at Boeing pushed the delivery schedule back approximately three months. First delivery to the British RAF is now scheduled for mid-1991. For the most part, Boeing has been successful in meeting the goals of the offset agreements even though it has encountered difficulties in receiving full credit for contract work placed with British firms which have not been qualified as approved defense contractors by the British Ministry of Defence. (Note: Some British critics, however, believe the promises of high-technology transfer have fallen somewhat short of program realities) (17:page unk).

Conclusion. Boeing's E-3 aircraft has proven itself to be a proven performer and an effective force multiplier whether deployed in Europe, the northern rim of North America, or the Persian Gulf. Current contracts with Boeing to upgrade antijamming communications capabilities, on-board computers, and the radar system as well as providing a link to the satellite Global Positioning System (GPS) will maintain the E-3's position as a nonprovocative deterrent to aggression well into the next century (6:1).

IV. Analysis

FMS Versus Direct Commercial Sales: The Issues

The DSAA brochure, "A Comparison of Direct Commercial Sales & Foreign Military Sales for the Acquisition of U.S. Defense Articles and Services" identifies the following six basic issues which are typically considered by foreign purchasers in choosing between FMS and direct commercial sales:

1. Ability to negotiate and administer an effective contract.
2. Logistics and training needs.
3. The need for DOD personnel assistance.
4. Contract price.
5. Delivery schedule.
6. The need for contracting flexibility. (27:1-6)

The intent at this point is not to rehash in detail the contents of the DSAA brochure. In the paragraphs that follow, the general issues listed above are evaluated against the specific example of the UK E-3 sale.

Ability to Negotiate a Contract

The United Kingdom has a well established domestic defense industry capable of satisfying most of its own military requirements. In fact, the UK defense industry's arms production capacity exceeds the domestic needs of its

armed forces creating the ability to export arms on a large scale. Although its relative rank as an exporter of arms has declined since World War II, the UK annually ranks among the top five exporters of military arms in the world. Consequently, the UK spends a relatively small portion of its defense budget on imports. As an example, imports of military arms have consumed less than five percent of the UK defense budget during most of the 1980s (2). Exceptions to domestic supply tend to be very high priced, small quantity hardware which would not be economically practical for the UK to produce or duplicate. Examples include the Polaris submarine and the E-3 AWACS.

To manage the acquisition of military equipment, the UK Ministry of Defence (MOD) has a Procurement Executive Office that centrally procures equipment for each of the individual military services. The Procurement Executive Office is a large bureaucratic organization predominantly staffed by career civil servants. These personnel are highly skilled contracting specialists with extensive experience procuring sophisticated military hardware from both domestic and foreign sources. When the decision was reached to procure the E-3 aircraft, the Procurement Executive Office had accumulated nine years of contracting experience on airborne early warning systems from dealing with GEC Avionics on the aborted Nimrod program.

Effective contracting with foreign sources requires familiarity with the foreign country's business set-up, laws and regulations. In acquiring arms from the U.S., the UK has used both FMS and direct commercial sales procedures. Prior to FY83, the UK relied predominantly on FMS in attaining U.S. military articles and services. Beginning in FY84 and continuing to the present, however, the UK has reduced FMS deliveries while significantly increasing its direct commercial sale imports (28). Figure 3 reflects the overall trend lines of FMS versus direct commercial sales to the UK during the 1980s. The trend lines indicate that the 1986-1987 decision to purchase the E-3 through direct commercial arrangements was a natural extension of Britain's deemphasizing FMS activities.

In conjunction with seeking proposals directly from interested, potential contractors during the spring of 1986, the MOD sought and gained permission from the Defense Security Assistance Agency (DSAA) to seek a FMS price and availability (P&A) proposals from the United States Air Force (Boeing E-3) and the United States Navy (Grumman E-2C and Lockheed P-3) (50:1). The DSAA decision to authorize the MOD concurrent consideration of FMS and direct commercial proposals was contrary to standard practice. Because the UK and U.S. governments enjoyed a long-standing "special relationship," however, the USG was anxious to

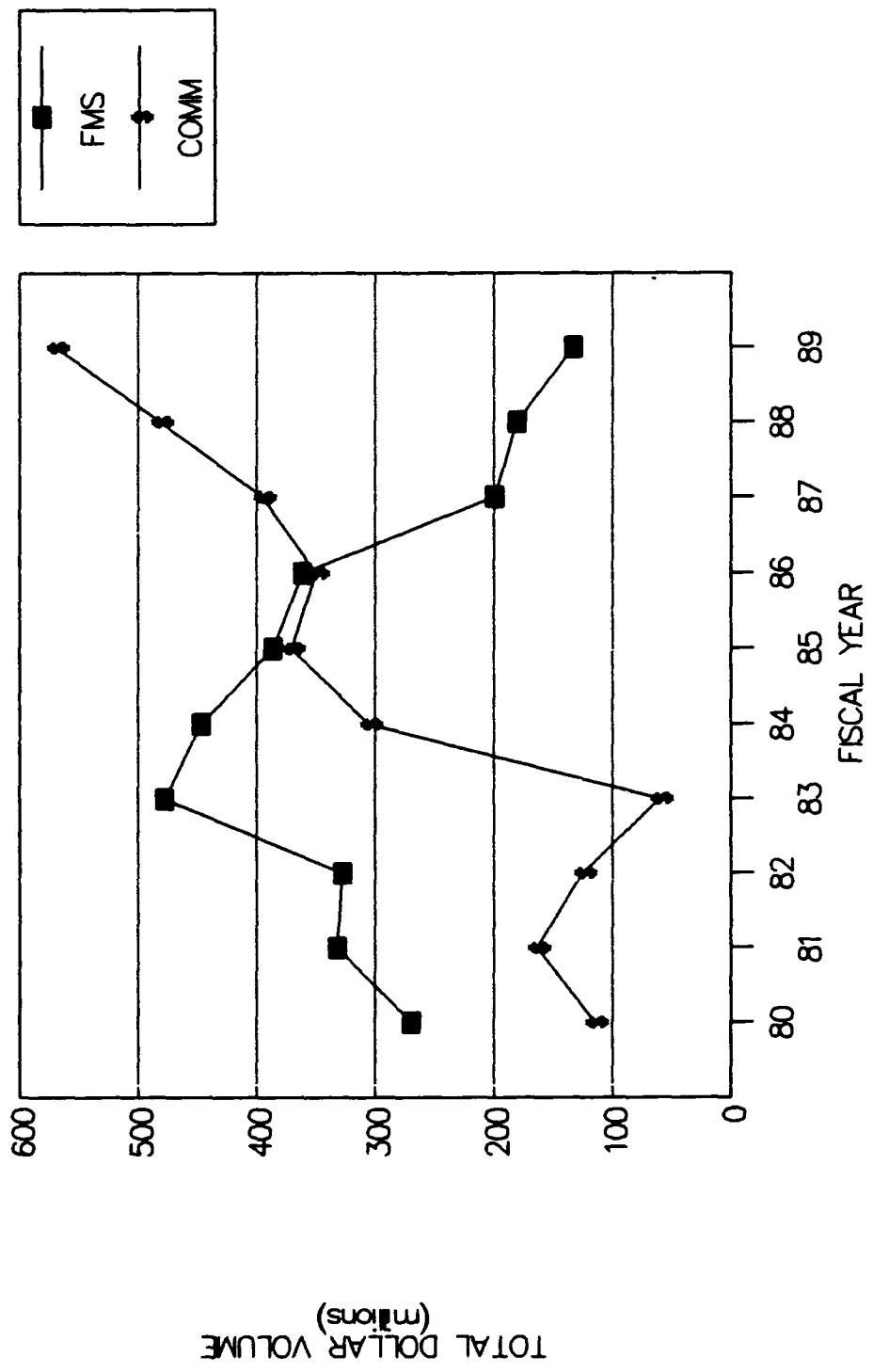


Figure 3. US Military Deliveries to UK:
FMS Versus Commercial (28:18-19, 48-49)

facilitate the UK's decision by providing as much information as possible in line with the UK's timetable for reaching a final purchase decision. Additionally, a British decision to buy American would have direct economic and employment benefits for U.S. industry, lead to greater interoperability with DOD and possibly NATO forces, provide economies of scale, and help defray DOD research and development costs either already invested in the various AEW systems or planned for future enhancements.

The timeframes imposed on various DOD activities to prepare and submit the FMS proposal package inputs were extremely stringent. The MOD Request for Tender dated 13 March 1986 requested the submission of a preliminary Not-to-Exceed (NTE) Rough Order of Magnitude (ROM) providing basic program cost estimates by 1 May. A more refined and detailed P&A package was to be prepared for delivery to the MOD by 16 June. Previous experience gained in pricing several other E-3 P&A packages (i.e., NATO, France, and Saudi Arabia) minimized the task imposed on the USAF.

Following the submittal of the ROM, a team composed of USAF, USN, Boeing, Grumman, and Lockheed personnel visited the UK and the main operating base at RAF Waddington 4-10 May to survey the operational, engineering, and technical facilities that would be available to support operations of the various U.S. AEW systems under consideration. Based on

the survey results, cost estimates for providing and supporting options for 5, 7 and 9 aircraft were revised downward with the results incorporated into full-fledged P&A proposals. On 15 July, the USAF P&A for the E-3 was briefed to the UK AEW team by HQ USAF/PRI, Directorate of International Programs. Although it appeared at this point that the RAF favored the E-3 powered by CFM56 engines, the USAF would have to await a final decision by the UK Ministry of Defence projected to occur in late October (51:1).

While the USAF was preparing its P&A package for the E-3, Boeing was diligently putting together its proposal and actively marketing it in the UK. As noted earlier, Boeing had learned from its previous unsuccessful attempts at getting the UK to sign up to the E-3 when the NATO buy decision was made years before. Throughout the course of the summer and the fall, Boeing refined its proposal. Initially, Boeing offered a 100 percent offset in high-tech work which was more lucrative than the offers tendered by Grumman and Lockheed. Then, when the competition had been narrowed down to Boeing and GEC Avionics in October, Boeing raised its offset offer to 130 percent and began discussions with MOD officials in November to develop tentative contract language assuming an affirmative decision by the MOD to acquire the E-3 through direct commercial agreement.

Although the final decision regarding the preferred system still lay ahead, it had become clear by October that the MOD did not intend to procure the E-3 through FMS channels (82:1). If the E-3 was selected, the DOD's role would be limited to providing those items and services under its control or ownership necessary to augment a Boeing contract and bring the E-3 into operational service with the Royal Air Force. In December, the MOD announced its selection of the E-3. Two months later the MOD signed the formal contract with Boeing.

To assist in contract administration and to facilitate the flow of data and information, the British in conjunction with the French established during the spring of 1987 a joint management office at Boeing's main offices in Seattle, Washington. Staffed by approximately 40 personnel drawn from various contracting, engineering and supply disciplines, the Joint Anglo-French Management Office (JAFMO) provides on-site contractor surveillance and direction as well as the technical and operational insight needed to effectively absorb the E-3 into the respective countries' air forces. The initial cadre of MOD personnel included four contracting specialists who had previously been posted at GEC Avionics overseeing the canceled Nimrod AEW program. Quality assurance of contractor performance was provided on a no-charge reciprocal basis by Defense

Contract Administration Service (DCAS) personnel assigned to the Boeing plants. Reciprocity consists of MOD personnel performing comparable contract administrative services (CAS) on USG defense contracts let with British firms in the UK.

To the MOD, purchasing the E-3 through FMS posed several problems. Notwithstanding considerations of price, delivery schedule and offset provisions which will be addressed later, the MOD did not want the USAF to act as a "middle man" under FMS procedures in negotiating and administering contract terms. Instead the MOD wanted to deal as directly as possible with Boeing to ensure that their contractual concerns received the desired degree of management attention. There was a feeling that under FMS procedures, MOD requirements would not receive the same sense of timeliness and priority from the DOD procurement system (80).

In summary, the MOD felt confident that it could negotiate and administer an effective contract with Boeing. The Procurement Executive had extensive experience in negotiating and managing major defense contracts with both domestic and foreign sources and had acquired specific experience in administering contracts involving highly sophisticated AEW hardware and software through the aborted Nimrod program. Additionally, based on previous experience in acquiring goods and services through FMS, the MOD was

confident that it understood what FMS provided and could make a well-reasoned choice between FMS and a direct commercial sale arrangement in satisfying its AEW needs from U.S. sources. Finally, the UK/U.S. AWACS MOU signed one day prior to the Boeing contract was viewed by the MOD as providing the vehicle for ensuring USG/DOD involvement and support for the commercial sale and filling any gaps that might occur in contractual coverage.

Logistics and Training Needs

An important consideration in the purchase of any major weapon system is the extent of logistics and training services required during both the acquisition and follow-on support phases. For an aircraft system to have useful capability, it must have the logistics infrastructure (i.e. equipment, communication network, facilities, ADP, personnel, etc.) necessary for operations and sustainment. The logistics and training aspects considered in each phase of the UK E-3 program are addressed separately in the paragraphs that follow.

Acquisition Phase. In both the logistics and training areas, the MOD envisioned a rather limited, albeit important, roles to be played by the DOD. In the logistics arena, the primary DOD functions were to be the provision of government furnished equipment (GFE), the provision of technical orders for common systems and equipment, the

continued development and possible incorporation of system enhancements, and the arrangement for the use of special tooling, equipment and laboratories owned by the DOD and other countries and located at the Boeing plants. For training, the USAF would provide technical training to a cadre of RAF personnel on equipment that was common to the USAF configured E-3 including aircrew and aircraft maintenance training. Contractor training would be provided for the CFM56 engine, flight simulator, and software and system configuration differences. The cadre of trained RAF personnel would then return to the UK as fully qualified instructors and provide training to other personnel.

A significant portion of the E-3's firmware and software components, test and cryptologic equipment, and special tooling is owned by the USG and had to be scheduled, leased, or purchased to satisfy Boeing's production line requirements. These GFE materials augment items provided by the MOD (such as ECM wing-tip pods) that flesh out the total UK configured E-3 system. The GFE provided by the DOD included all COMSEC equipment, microchips, UHF radios, TACAN, life rafts, strobe lights, etc. Some of the DOD provided GFE such as the MECL II microchips were "life of buy" items procured by the DOD through a one time quantity purchase following announcement by the sole source

manufacturer (Motorola for the MECL II microchips) of its plans to discontinue production.

In the area of asset use, the USG, NATO, and the Saudi Arabian Government (SAG) collectively had purchased over 40,000 items of special tooling, special test and support equipment, etc. totaling over \$125 million in value to support their particular E-3 production contracts with Boeing. Use of this equipment was needed on a timely basis to preclude any delays in production for the UK E-3 program.

Follow-on Phase. A diminished follow-on support role was forecast for the DOD whose responsibilities would be generally limited to evaluating potential system improvements, providing technical analysis and advice concerning aircraft structural integrity drawn from operational experience, and providing avionics software support. As stated previously, the MOD's long-term objective was to attain the maximum degree of independence in the operation and sustainment of their E-3 aircraft as soon as practical following initial delivery. Toward this end, the MOD projected that:

1. Continuing technical training would be provided by a cadre of qualified RAF instructors with training associated with system enhancements provided by a combination of contractor and USAF resources as appropriate.

2. Depot level maintenance would be provided on an interim basis by a combination of FMS and contractor support pending establishment of an organic UK capability.

3. Supply replenishment would be provided largely through direct commercial contract except for high-value, low usage common reparables which would be supported through FMS under cooperative logistics supply support arrangements (CLSSA).

4. A variety of post production engineering services would be provided by Boeing in cooperation with UK firms.

The Need for DOD Personnel Assistance

The MOD has a highly skilled workforce capable of directly purchasing the E-3 and associated support elements, absorbing the aircraft into its inventory, and maintaining (or at least attaining domestic contractor support) the aircraft during its planned useful life. Under the scheme as originally envisioned, Boeing would provide the bulk of services and material through the direct commercial contract. The DOD would provide:

1. Maintenance training on standard E-3 components/systems and operations training for mission crews.

2. Technical data necessary for the MOD to plan for operational use and long-term indigenous support of the E-3.

3. USG assets and equipment necessary to accomplish production.

4. Various, standard FMS support services following aircraft delivery (for example, spare parts replenishment for selected common items, technical services concerning maintainability and system modifications, etc.).

Unlike the E-3 sale to Saudi Arabia, there is no requirement for DOD personnel to be in the UK to either help manage facility and communication network construction during the acquisition phase nor help operate and/or maintain the aircraft following delivery. The MOD has a strong support infrastructure already in place and functioning.

Contract Price

The commercial quote tendered by Boeing was significantly less than the FMS price presented by the USAF and was a major, if not overriding, consideration in the MOD's decision to acquire the E-3 through a direct commercial arrangement (24; 79; 80). As noted in the background material included in chapter III, the MOD's selection of the E-3 over the Nimrod AEW was politically sensitive considering the amount of funds already invested

in the Nimrod program and the potential adverse effects on employment in the UK aerospace industry. Consequently, the MOD was very interested in getting the best value possible while attaining the inflow of high tech work to compensate for the cancellation of the Nimrod program. The 130 percent offset negotiated with Boeing satisfied the latter requirement while the former need appeared best met through a direct commercial sale.

In the FMS price and availability (P&A) quote provided to the MOD, the USAF priced what the total E-3 system should cost. Employing a total package approach, the P&A addressed all necessary support elements in addition to the aircraft system itself. In some instances, the P&A contained items in excess of the Cardinal Points Specification (CPS) delineated in the MOD's request for tender but considered vital by the USAF in meeting the RAF's operational requirement. The price tag presented was a best estimate built on pricing data provided by Boeing as amended by most recent USAF experience with the FMS sale of the E-3 to Saudi Arabia. The pricing data provided by Boeing was based on a projected fixed-price incentive (FPI) contract which the USAF believed would be the most advantageous acquisition mechanism. The true cost would not be ascertained until actual contract award following several months of definition and fact finding.

The Boeing direct commercial proposal was priced very strictly according to the CPS. The quoted price was based on a firm fixed price (FFP) contract being signed with the MOD. If adherence to the CPS was the lone criterion for contract award, a contract could be promptly signed between the MOD and Boeing following the MOD's aircraft selection decision. Any subsequent MOD desires to redefine its requirements/specifications following contract signature could only be implemented at additional cost to the MOD.

Under a fixed-price incentive contract, "the parties negotiate a target cost, a target profit, a price ceiling, and a formula for establishing the actual profit to be paid." (3:Ch 4-14) The profit formula is based on a sharing ratio between the parties of costs over a target cost threshold but less than an established price ceiling (typically set at 120 percent of the target cost). Cost risks are shared by both parties.

The firm fixed-price contract holds the highest risks for the contractor but also offers the opportunity for the greatest profits. Under a FFP contract, the parties agree on a fixed price for the delivery of specified items within a prescribed delivery schedule. The advantage to the buyer is that the contract price will remain constant unless a change is made to the contractual requirement. For a

program spanning several years like the E-3 acquisition, this feature facilitates long-range budgetary planning.

Delivery Schedule

The comparative delivery schedules projected for FMS and offered through direct commercial sale were another important consideration in the MOD's selection choice (79). In 1986, the MOD's airborne early warning capabilities resided in its fleet of aging Shackleton aircraft which had been in service for 30 years and were fast approaching the end of their useful lives. The Nimrod AEW which had been in development for seven years was intended to be the replacement aircraft. However, due to difficulties encountered by the Nimrod AEW in attaining the RAF's specified performance requirements, the MOD was confronted with two highly undesirable alternatives --- either sink additional funds in maintaining the increasingly expensive Shackletons or accept a gap in AEW capability while the Nimrod's problems were being worked out. Neither prospect was attractive. Consequently, the MOD sought to expand their options by soliciting offers from interested AEW manufacturers.

Boeing was well prepared to satisfy the MOD's delivery schedule needs. Boeing's production line was still in operation with the last of E-3s purchased by Saudi Arabia yet to be delivered and work continuing on an USAF order for

E-6 command and control aircraft which, like the E-3, are built on a modified 707-320B commercial airframe. Having established Boeing's ability to respond in a timely manner, the MOD had to next determine which of the two acquisition methods, FMS or direct commercial sale, provided the optimum delivery schedule.

In the P&A prepared by the USAF, it was projected that seven aircraft could be delivered by the end of FY91 (43). This projection was based on several assumptions including a 1 October 1986 LOA approval date, a 1 January 1987 contractor start date with full contract award by 1 September 1987, a 40 month production time for each aircraft, and an annual production rate of four aircraft. In its commercial offer, Boeing promised first aircraft delivery in January 1991 with delivery of the seventh aircraft occurring in January 1992. This schedule envisioned a production rate of six aircraft per year. On the surface, the FMS and commercial delivery schedule proposals appear to be quite comparable. Upon further investigation, however, the proposals differed significantly based primarily on the underlying assumptions that were used in developing each one. The results of this analysis are presented in the next chapter.

Contracting Flexibility

Under FMS procedures, the DOD takes a hands-off view regarding a purchaser's desire for offset work in exchange for a buy decision. While recognizing that offsets have become a reality of doing business in today's arms market, the DOD nevertheless refuses to be a guarantor of offset arrangements except when very specific circumstances apply. (for example, no other feasible alternative exists or the deal is of significant importance to U.S. national security interests) (5:130). According to DOD policy issued in 1978, the responsibility for negotiating and fulfilling offset arrangements rests squarely on the shoulders of the U.S. contractor(s) involved.

A commercial contract can provide additional benefits to the purchasing country beyond those readily available under FMS procedures (27:22). As mentioned in Chapter III, a compelling consideration in the MOD's selection of the E-3 was the offset proposal proffered by Boeing. Boeing's offer of 130 percent in offset work to UK industry may well stand as the record to this day (5:129). In essence, Boeing's offer represented a promise to place contracts with UK firms at a value 1.3 times the purchase price of the E-3 (approximately \$1.6 billion).

Offsets can be both direct and indirect in nature. Direct offsets consist of work pertaining to the military

equipment being acquired. Indirect offsets can range from work performed for the supplying contractor on other business ventures to the contractor's agreement to purchase or help market goods and services produced by the purchasing country. The general type of offset arrangements available include coproduction, licensed production, subcontractor production, overseas investment, technology transfer, and countertrade. A definition of each of these types of offsets is provided in Appendix C.

In the case of the UK E-3 sale, offsets included both direct and indirect commitments. To satisfy the direct portion of its obligation, Boeing placed a part of the E-3 program workload with qualified UK firms. The indirect portion of the offset arrangement is being satisfied by the placing of work in other high technology defense and commercial aerospace programs. The UK's stated objective in pursuing the offset arrangement was to encourage UK industry in advancing its capabilities, broadening its product base, and improving its competitiveness (77:Annex XII).

Under a commercial sale arrangement, offset obligations can be included as a part of the contract instrument and are just as binding on the contractor as any other contract provision. For the purchasing country, this feature greatly simplifies the total acquisition process by providing a one

step procedure. The total program package can be consummated at one time.

Although offset provisions cannot be included as a part of FMS negotiated contracts, they can be addressed under separate contractual arrangements mutually agreed to by the purchasing country and the U.S. contractor. The net effect of this approach for the purchasing country, however, is a two-step process which will likely take longer to negotiate and could result in disconnects between the FMS contract and the offset arrangement since the negotiating parties are different in each case. This consideration probably weighed heavily in the MOD's decision to go with a direct commercial sale. As noted earlier, the MOD's selection decision was politically sensitive. Anxious to quell any public fears about the possible loss of British jobs in a high-tech industry, the MOD wanted to expedite consummation of the deal including the provision of offset arrangements. Contracting directly with Boeing under a direct commercial sale appeared to best satisfy this particular need and, in fact, the MOD was able to announce within three months of its selection decision that the offset program had been contractually agreed to by Boeing.

V. Findings

Ability to Negotiate a Contract

The MOD's objective was not only to acquire the E-3 system with accompanying support equipment and services necessary to sustain the aircraft during initial activation of the system but to also attain the technical knowledge required to independently overhaul and maintain the aircraft and major components, perform system integration, redesign the aircraft and software systems to meet changing operational requirements, and to re-export the technology involved (59). It soon became apparent, however, that the Boeing contract (as augmented by the MOU) fell far short of MOD expectations in its ability to satisfy the outcome sought by the MOD. In the paragraphs that follow, specific examples where contractual expectations fell short of program realities are explored. The items discussed are not necessarily all inclusive of the contractual issues arising but are intended to provide the reader with the flavor of the more significant program concerns.

Data Disclosure. A recurring problem that has plagued the program from day one has been data disclosure. The subject has been a continuous source of high level concern on both sides of the Atlantic. The root cause of the problem stems directly from the lack of specificity regarding the issue in both the Boeing contract and the MOU.

Although internal administration issues concerning processing channels and timeliness of releasability decisions have occurred, the USG government policy concerning data disclosure has been generally steadfast throughout the program's course (i.e., the USAF reviews all specific requests for technical data and determines releasability on a case by case basis according to National Disclosure Policy as promulgated by disclosure delegation letters). What was lacking was a clear understanding by the MOD regarding what technical data it would and would not receive and, if releasable, at what cost. From the program's outset, therefore, the MOD had a faulty conception regarding the extent of and the ease by which technical data would be released to it (80). (Note: The issue of data disclosure would have arisen even if the sale had been handled through FMS. The problems experienced form a part of program "lessons learned" which will be addressed in Chapter 6.)

The most contentious areas of data disclosure have involved engineering drawings, test data, and computer software source codes. A brief review of the pertinent sections of the Boeing contract and the MOU revolving around the data disclosure issue provides insight to the misunderstandings arising. For instance, the contract requires Boeing to provide detail drawings, specifications,

technical data, flight test data, and software source codes. For its part, the MOU states that the USG will provide through LOAs technical information, computer software, and results of USAF tests relevant to the UK AEW system. Collectively, the contract and MOU language form the root of the data disclosure problem, creating a false impression of the USG's readiness to release sensitive technical data, and formed the source of the MOD's frustrated expectations.

Due to the expeditious rate at which the contract and the MOU were consummated following the MOD's selection decision, an upfront, detailed analysis by the DOD of various releasability issues involved was not possible. Nor does it appear that the full extent of the specific releasability issues involved were fully recognized by the principal parties concerned. This apparent lack of understanding is reflected in the DSAA memorandum attached to the MOU. The Memo states that the USG (as represented by DSAA) "agreed with the UK to not include words throughout the MOU on releasability." Instead, by mutual consent, the issue of releasability was addressed simply by stating that the acquisition would be "carried out in accordance with the national laws, regulations, policies, and procedures of both governments" (31:1). Consequently, the releasability of specific, sensitive technical data was left to after-the-

fact discovery at mid-program with the accompanying adverse impacts on DOD credibility in the eyes of the MOD.

Special Services. In addition to the lack of clarity concerning the general issue of data disclosure, the Boeing contract was underspecified and underfunded. Two prominent areas were involved, depot level maintenance (DLM) and post design services (PDS). Each area will be addressed in turn in the paragraphs that follow.

Depot Level Maintenance. The MOD's policy objective toward depot level maintenance is to establish to the maximum extent possible an organic capability in the UK over the long term (83:1). A combination of FMS and interim contractor support will provide DLM in the short term following initial aircraft delivery. This support structure will yield to ever-increasing domestic repair activity as the RAF attains operational experience with the E-3.

The MOD believed that the provision of DLM technical data to assist in the formulation of maintenance policies was contained in Clause 18 of the Boeing contract. In part, this clause states that Boeing will supply print drawings, copies of specifications and/or manufacturing information, maintenance, overhaul, repair, test, operating or other information handbooks. After contractual review, however, this particular clause was determined not to cover the specific information retrieval and consultative and

analytical services requested by the MOD (for example, provision of E-3 historical and maintenance data, provision of depot repairable part lists, analysis of the part lists relative to existing configurations, capability assessment of potential maintenance contractors relative to specific parts, etc.). Consequently, to attain the needed data, the contract had to be amended at a minimum additive cost of over \$1 million to the MOD.

Post Design Services. The Boeing contract does not provide for the full range of post design services (PDS) expected by the MOD (86:1). PDS "comprises a range of essential support functions such as structural integrity work, configuration control, the maintenance of technical publications, and design of modifications, investigation of defects, and so on" (45). PDS responsibilities fall under what the MOD broadly defines as design authority and are required from the date of entry into service of the first E-3 aircraft. Under the PDS concept, the MOD envisions Boeing acting as a coordinating design authority for the whole system with a UK company acting as the central link for UK based activities (61). The UK's policy objective is to eventually attain the engineering capability necessary to support the aircraft for the whole of its service life. Technical expertise and knowledge would slowly transition

from Boeing to UK firms following a similar pattern established earlier for the F-4 aircraft (85).

The MOD considered that the statement of work (SOW) adequately covered the post design services required to support the operational use of delivered aircraft. Upon review, however, most of the services were determined to be outside the scope of the SOW and have had to be separately priced as an additive cost amendment to the contract. Additionally, the MOD has discovered that Boeing cannot perform the full range of services normally performed by UK firms delegated design authority (80). Consequently, some responsibilities will be shared between Boeing and a UK firm yet to be designated while other functions will be covered by MOD participation in the USAF's E-3 Technical Coordination Program (TCP).

Logistics and Training Needs

Acquisition Phase. In the contract negotiated between the MOD and Boeing, numerous assumptions were made about the USAF's ability to support the sale "which proved to be erroneous, embarrassing, and/or costly when the USAF was unable to deliver as anticipated." (47) The faulty assumptions arose due to the lack of USAF involvement during negotiations between Boeing and the MOD. The rapidity at which the MOU and contract were consummated following the source selection decision precluded proper consideration and

understanding by the MOD of the full measure of the logistics support responsibilities and tasks levied on the USAF. The following paragraphs provide examples of the logistics support problems that arose during the acquisition phase.

Government Furnished Equipment (GFE). In the area of GFE, need dates were contractually established without any USAF input regarding whether the equipment was available and, if available, could it meet production schedule requirements. Initially, the USAF identified numerous items whose projected availability would be later than the required date in the production schedule. To compensate, the USAF developed work-around actions in conjunction with Boeing and applied intense management effort first to locate items and then to ensure expeditious delivery by DOD sources of supply.

As in the case of data disclosure, the USAF's raising of warning flags early in the program regarding its ability to deliver GFE on time prompted the MOD to again view the USAF as an unexpected impediment to the program contrary to the spirit of the MOU. The problem, however, stemmed not from any failings in USAF desire to facilitate the program schedule but from a lack of awareness concerning support commitments made on its behalf and included in the Boeing contract.

Besides the difficulties encountered by the USAF in meeting its schedule commitments, the provision of GFE items was complicated by a moving requirements baseline.

Following contract signature, Boeing identified additional GFE items and adjusted the quantities of GFE items previously required to support production. The MOD took the position that it should not be held responsible for any adverse program impacts if the additive GFE was late to need or not of the specified standard. "The provision of GFE over and above the original contract requirement could only be on a best endeavors basis." (8)

In response, Boeing noted that once the MOD had contractually agreed to supply all GFE items needed, Boeing was not liable for late or deficient GFE. If the required GFE could not be provided on time, Boeing would be relieved of its responsibility to deliver aircraft according to the contracted schedule resulting in additional program costs to the MOD. Accordingly, considerable pressure was brought to bear on the USAF to ensure the provision of GFE would not be a cause for program slippage. Although some GFE problems were not completely resolved until over 12 months into the program, no adverse impact was experienced in the production schedule. The MOD eventually praised the USAF for bringing order to the whole situation but not until many anxious moments had passed (9).

Asset Use. According to contract language, the price and performance commitment agreed to by Boeing was contingent on the use of assets (i.e. special tools, test equipment, etc.) owned by the USG, NATO, and Saudi Arabia and located at Boeing's plants (77:Clause 30). Many of these assets were one-of-a-kind items possessing relatively high unit costs and long acquisition leadtimes. Attaining authority to use these assets was considered a top program priority (7). However, the assets could only be provided to the extent that such use did not interfere with the completion of outstanding contractual obligations on existing E-3 contracts with the USG, NATO, and Saudi Arabia.

During the summer of 1987, the USAF granted authority to use its assets on a non-interference basis; all rental charges were later waived. Several months later, NATO authorized use of its assets on a non-interference, rental charge basis. As it turned out, Saudi Arabian authorization was not required because the residual property accountable under the Royal Saudi Air Force contract was actually owned by the USG.

Considerable USAF staff effort had to be expended in assessing the appropriateness of using USG and NATO assets and attaining the necessary authorizations. Fortunately, the time required in gaining approvals did not adversely affect either the UK program schedule or the contract price.

Here again, however, the USAF had to scramble to make good on a contractual commitment to which it had not been a party. Ideally, the USAF should have been adequately consulted prior to contract signature to ensure that the availability of USG and NATO assets would not jeopardize contract performance and program cost. (Note: Section 8 of the MOU addresses only the use and disposal of tooling procured by the USG through LOAs on behalf of the UK; it did not address the use of any existing special tooling that had been acquired to support non-UK program activities.)

Special Services. From the program's outset, the MOD misperceived the services that Boeing could and was contractually obliged to provide (80). Realizing that Boeing could not provide the full range of services required to effectively introduce the E-3 into the RAF's inventory, the MOD soon began to seek a variety of logistics, engineering and technical consultative services from the USAF that were needed to augment Boeing's efforts. MOD questions were directed to the USAF regarding such matters as software support planning, spares analysis, aircraft jacks, etc (66).

If the E-3 transfer had been conducted under FMS procedures, most, if not all, of these special services would have been provided (or at least offered) by the USAF via a LOA. In constructing any weapon system transfer

proposal under FMS, the DOD takes a total package approach. Under this concept, all support requirements beyond the immediate end item being purchased that are perceived by the DOD as being essential to the effective introduction of the weapon system are considered in the development of a LOA. A more in-depth discussion of this particular matter will follow later in the chapter when the issue of comparative price between the FMS and commercial sale proposals is explored.

In reacting to the MOD's requests for assistance, the USAF responded as best it could within its existing resources. To provide the full range of services being sought by the MOD, however, additional resources were required by the USAF. The LOA covering the provision of GFE funded some extra USAF manpower but only to the extent needed to manage that particular effort.

During the summer of 1987, the MOD held extensive discussions with USAF officials regarding the range of support services that the USAF could furnish (84). The talks culminated in the MOD signing a LOA in December 1987 establishing the E-3 Acquisition Support Program (ASP). Through a combination of USAF and contractor personnel experienced in E-3 support matters, the LOA funded needed services covering a three year period at a cost close to \$2 million.

The ASP encompasses a wide range of logistics and technical services provided by the AFLC E-3 System Program Management (SPM) Office (located at the Oklahoma City Air Logistics Center, Tinker AFB, OK) and engineering, disclosure review, and contractor interface services furnished by the AFSC E-3 System Program Office (SPO) (located at HQ Electronics Systems Division, Hanscom AFB, MA). By Air Staff direction, the E-3 ASP is managed by the E-3 Acquisition Support Group (ASG) at OC-ALC which "serves as the single point of contact for providing UK/ROF logistics and technical support in resolving development/production problems and providing modification information /review." (44:6) Specific services supplied by the two supporting commands are delineated as follows:

AFLC

1. Plan for and develop software maintenance support.
2. Evaluate contractor prepared engineering change proposals to ensure logistics supportability.
3. Analyze contractor provided maintenance and reliability data to ensure adequate spares levels are identified.
4. Provide USAF common technical orders and procure Country Standard Technical Orders (CSTO).
5. Evaluate proposed system enhancements being developed by the USAF to identify logistics requirements.

AFSC

1. Conduct data disclosure reviews and provide/attain disclosure approvals as appropriate.
2. Evaluate and recommend engineering change proposals.
3. Coordinate/plan for future cooperative research and development efforts involving system enhancements.
4. Acquire contractor information.
5. Provide consultative services regarding contract issues and contractor past performance, plans, and schedules.

Establishment of the E-3 ASP allowed the USAF to satisfactorily meet its support commitments and obligations as outlined in both the Boeing contract and the MOU. Without the additional resources funded by the ASP LOA, the USAF would have had to support program efforts on either a time available basis or at the expense of other ongoing programs. Neither alternative was attractive. Through the ASP, the USAF was able to work outstanding issues/questions that had arisen since February 1987 not least of which was a backlog of disclosure determinations that threatened program schedules and the overall credibility of DOD's support for the program.

While the ASP provided the mechanism for furnishing needed services, its creation also reflected some of the

internal organizational spasms being experienced within the USAF structure. Under a normal FMS sale of the E-3, Headquarters USAF/PRI would have been the overall case manager with program management responsibilities assigned to the E-3 SPO at Electronics Systems Division. Although program management responsibility for the USAF's E-3 fleet had transferred from AFSC to AFLC in 1984, AFLC's role in a FMS sale would have been limited to acting as a manager solely for those LOA case lines involving AFLC managed support.

AFSC through its product divisions is generally regarded as the USAF's acquisition command for major systems. Although a fairly mature system by 1987, the E-3 was nevertheless still a production aircraft. Consequently, responsibility for managing a FMS program would have normally fallen on AFSC's shoulders. However, "when the commercial purchase decision was made, normal FMS acquisition channels were closed off." (67) Under a FMS system transfer, country funds would have been provided through a LOA to staff a comprehensive USAF program management capability. Lacking this normal source of additional funding and program structure, innovative organizational support procedures had to be developed.

As a product of necessity, the ASP was initially designed to provide consultative services within a limited

scope. When the ASP LOA was implemented in December 1987, program management responsibility was retained by HQ USAF/PRIW. As the program unfolded further, however, there was general agreement that the USAF's involvement was proving to be more extensive than originally anticipated (46). In recognition of the expanding nature of the USAF's role, program management responsibility was eventually delegated in December 1988 to the E-3 SPM at OC-ALC functioning through the Acquisition Support Group. This action clarified the respective roles and functions of the various USAF organizations involved in the program and settled numerous "turf" issues that, at times, had threatened the orderly conduct of support activities. (Note: The delegation of program management authority and responsibility to the E-3 SPM was limited to the UK and ROF programs; the issue of the assignment of program management responsibility for any future FMS sales is still undecided.)

Follow-on Phase. Logistics support for delivered aircraft will be provided through a combination of USAF, contractor, and organic UK services. To the maximum extent possible and practical, the MOD will strive to attain self-sufficiency in support activities through either internal RAF capabilities or direct commercial contracts. Follow-on training will be largely accomplished by a cadre of RAF instructors who have received technical training from either

the USAF or contractors. However, due to various economic and technical capability considerations such as the cost of acquiring or maintaining certain reparables, system integration knowledge retained by the USAF and U.S. contractors, and restrictions placed on the release of sensitive technical data, the MOD will continue to seek logistics assistance from the USAF support structure. Specific examples of USAF follow-on support are addressed in the paragraphs that follow.

Special Services. Except for a few residual tasks involving primarily the collection and release of technical data, many of the functions currently performed under the auspices of the Acquisition Support Program will transition to the Technical Coordination Program (TCP) following aircraft delivery. Funded by FMS LOAs, the TCP provides participating countries with a set of standard logistics and technical services that are structured around individual aircraft systems (for example, separate programs exist for F-4, F-5, F-15, F-16 and E-3 aircraft). The TCP is implemented by AFLC through Technical Coordination Groups (TCG) co-located with the system program management offices for the particular systems. In the case of the E-3, the TCG is organized within the E-3 SPM at OC-ALC.

The goal of the TCG is "to help member countries improve aircraft serviceability, maintainability, and

reliability through improved parts, maintenance techniques, inspection, overhaul interval, and modifications." (48:Sec 3.4.2) To meet these goals, the TCG serves as a general clearinghouse performing the following activities for the mutual benefit of member countries:

1. Evaluate proposed system modifications against operational requirements.
2. Maintain a current reference file of technical orders to ensure the compatibility of proposed system modifications.
3. Compile and analyze maintenance data involving repair history, material deficiency reports, safety hazards, reliability of parts/components, etc.
4. Evaluate engineering change proposals and provide recommendations to participating countries.
5. Upon request, assist in the investigation of aircraft accidents and incidents.
6. Upon request, assist in acquiring critical item support.
7. Maintain E-3 configuration baseline including the Aircraft's physical design but other elements such as electromagnetic compatibility, system/component reliability, etc.

As of this writing, the MOD has yet to sign a LOA formally joining the E-3 TCP. The delay in MOD acceptance

appears largely due to the MOD's need to sort out the respective services to be provided by the TCG versus the post design services being sought from Boeing. By regulation, TCG services are not tailored to individual country needs. To minimize redundancy and cost, therefore, the MOD is being careful to properly gauge what services will be needed from Boeing that will not duplicate the standard services provided by the E-3 TCG.

Assuming MOD participation in the E-3 TCP, the support task confronting the TCG will be complicated by the lack of a clearly defined configuration baseline for the UK aircraft. This deficiency is rooted in the nature of the Boeing contract which, as noted earlier, is performance oriented allowing the substitution of best commercial practices for USG MILSPECs. Some of the aircraft components and parts, therefore, may prove to be incompatible with the E-3 aircraft already in service with the USAF and NATO. At a minimum, unique or uncertain equipment and systems configurations will hinder future system upgrades and modifications. System changes may not be possible, installation delays may occur, and costs could rise in accommodating the "unique" features of the UK E-3 configuration (73).

Supply Support. Boeing's use of best commercial practice results in equipment that, although it may satisfy

performance criteria, may be unidentifiable/non-standard to the DOD/USAF logistics support system. Parts are marked with peculiar Boeing identification numbers and do not get catalogued into the DOD/USAF supply system. Without additional FMS funding for DOD cataloging services, the MOD will become dependent on either Boeing supplying replacement parts and required support equipment or its own ability to directly contract commercially for replacement parts based on the drawings, specifications, and parts breakdowns provided by Boeing under the contract SOW.

If support is sought from Boeing, the MOD may end up paying premium prices because Boeing will add an administrative processing charge for acquiring and transporting material manufactured by its subcontractors. On the other hand, if the unique items could be cataloged into the DOD supply system, material could be either attained from the original manufacturer or alternative sources developed. Lower per unit prices could result. The same result can conceivably be achieved by the MOD depending on its ability to negotiate cost-effective contracts directly with commercial firms. (Note: As of this writing, the MOD has made no commitment to enlist DOD cataloging services.)

General USAF supply support will be provided through various FMS cases. Separate cases will be implemented to

furnish publications, supply replenishment spare parts, and perform depot level maintenance of selected reparables.

Spare parts that are standard to the DOD logistics system will be provided through a cooperative logistics supply support arrangement (CLSSA) under FMS procedures. CLSSA requires an up front country investment in the DOD/USAF supply system to establish an equity level for the type and quantity of spares needed to satisfy projected requirements. The investment permits the DOD/USAF to purchase supplemental stocks on behalf of the customer country in anticipation of actual need. Purchased material is comingled with DOD/USAF assets and the purchaser country can draw upon the combined stock inventory according to the Force Activity Designator (FAD) assigned to it. As items are requisitioned, additional country funding is provided to maintain stock levels (30:Ch 19-4).

In theory, CLSSA should, in part, replenish the in-country stocks of spare parts provided by Boeing as part of the initial spares support package. By contractual agreement, Boeing is required to furnish all appropriate "repairable and nonrepairable spares" needed to support UK fleet operations for a 30 month period commencing upon the delivery of the first E-3 (77:Clause 21.1). The stated support objective for the initial 30-month period is that 95 percent of the required spares will be available upon demand

during any consecutive twelve month period. Spares requirements are calculated on such considerations as fleet population, planned flying hour program, level of maintenance (i.e. operational, intermediate, or depot), condemnation rates and failure rates based on reported data from USAF/NATO or predictions (best estimates). Should fill rates fall below a 90 percent level, the reasons for the shortfall will be evaluated by the MOD and Boeing to determine cause. If the operational parameters have not changed from those specified in the contract, Boeing will provide additional quantities of spares at no additional cost to the MOD. However, if the shortage results from changes in the parameters outside of the control of Boeing, then the MOD will be responsible for funding additional sparing. An example would be a change in the flying hour program from that originally planned by the RAF.

As in other areas, the calculation of the 30-month spares requirement illustrates the respective risks incurred by the MOD and Boeing in executing a performance oriented, fixed-price contract. Boeing's contractual obligation is to provide 30 months of spares. The baseline requirement is continually updated based on current operational data. While required quantities can change based on failure rates (either up or down), the cost of providing the level of support will remain fixed. Should failure rates improve,

Boeing's margin of profit will increase with the reverse applying should failure rates worsen. Relying heavily on USAF failure rates which have improved measurably since 1987, Boeing has revised the spares requirement downward from the original projection at a potential, estimated cost savings to Boeing of \$36 million (24).

Boeing's current spares projections will result in reduced quantities being provided to the MOD. There is concern among USAF personnel that the present level of sparing will not cover the full 30-month initial operational period resulting in shortfalls before the follow-on DOD/USAF supply support under CLSSA can kick in (24). The problem is contractual in nature and revolves around the data base(s) being relied upon by Boeing in calculating the spares requirement. Different requirement computations can be attained depending on the source of the failure data (i.e. Boeing, USAF, NATO, or some combination thereof).

Depending on the outcome of current contract discussions, the MOD will be faced with a choice of alternative courses of action. If no upward adjustment is made by Boeing, the MOD can delay taking any immediate action by waiting to see what actual usage rates are, they can pump more money into the contract now to purchase additional "insurance" spares, and/or place pressure on the USAF later (if the need arises) to draw down DOD stocks in

advance of the CLSSA implementation. The latter possibility could prove particularly troublesome for the USAF to support during an era of declining operating budgets which historically have resulted in reduced spares levels.

Depot Level Maintenance. As mentioned before, the MOD's long-term goal is to establish to the maximum extent possible and economically practical an organic capability to repair E-3 component parts. The movement toward self-sufficiency will be evolutionary involving a combination of FMS, US contractor and UK organic capabilities.

Pending establishment of UK organic repair capabilities, interim depot level maintenance will be provided by the USAF and Boeing. For repairable items standard to the USAF E-3 configuration, the USAF will provide repair support. The repair of components with failure rates of at least one per year will be accomplished through CLSSA on a repair/replace basis (as opposed to repair/return). Standard components with failure rates of less than one per year will be repaired on a unprogrammed basis through a blanket order FMS case. Boeing will initially handle the repair of non-standard components which include items that are unique to the UK E-3 configuration, items that are slightly modified from the USAF standard configuration but are not identifiable in the USAF logistics

system, and items that are common to the Royal Saudi Air Force E-3 configuration but non-standard to the USAF configuration.

Long-term plans for depot level maintenance support call for maximum use of UK organic capabilities. A number of components are already in the RAF inventory for which organic repair facilities currently exist. Additionally, there are a number of qualified repair sources in the UK capable of repairing air vehicle components which are either common or very similar to components found on Boeing's commercial 707 aircraft. Continued FMS support for the repair of technologically sensitive components (for example, COMSEC and crypto equipment, certain components of radar and navigation/guidance equipment) will be required.

The extent of the evolution toward independence in UK depot level maintenance hinges on data disclosure decisions presently being weighed by the USG. To facilitate the solicitation of potential UK contractors, the MOD has requested the USAF and Boeing to develop technical data packages. Except for items for which UK depot level repair has been either specifically precluded (for example, COMSEC equipment) or awaits a final release decision, the USAF has authorized release of data relating to a large portion of components standard to the USAF/NATO configuration.

Numerous releasability decisions, however, still loom ahead for nonstandard components for which the USAF does not have data rights. Once Boeing has put together its data package, the USAF will have to conduct a case by case review of each component involved to ensure that U.S. national security interests are not compromised. This review process may further delay the MOD's timetable in soliciting tenders from prospective UK repair sources and, as a result, extend the interim period of dependence on FMS and Boeing repair support. The MOD had planned to issue a request for proposal to UK industry as early as the fall of 1989 but had to postpone the solicitation pending receipt of needed technical data from the USAF and Boeing.

Avionics Software Support. To sustain the capability and interoperability of the world-wide E-3 fleet, periodic updates are performed on the software of various on-board and ground avionics systems. Software services are provided through the E-3 Avionics Integration Support Facility (AISF) located at OC-ALC. At present, the AISF supports the following software for the USAF and NATO:

1. Surveillance Radar Computer Program (SRCP).
2. Surveillance Radar Maintenance Computer Program (SRMCP).
3. Surveillance Radar Ground Support Computer (SRGSCP).
4. Navigation Computer Program (NCP).

5. Maintenance Computer Program (MCP).

(Note: The Royal Saudi Air Force (RSAF) has not received any software support following the delivery of its E-3 aircraft. Various priced support options have been presented but the RSAF has yet to exercise any of the alternatives.)

The AISF's resources are currently saturated in supporting USAF and NATO requirements and cannot satisfy the demands of any additional customers without an increase in space, equipment, and personnel. Multiple hardware configurations and software baselines, ongoing fleet modifications, and equipment loading limitations are factors which affect AISF support requirements. The extent to which additional resources will be required is dependent on the degree of commonality between the standard avionics software configuration of the USAF/NATO aircraft and that of any additional AISF customers.

The MOD is currently planning for its avionics software maintenance needs following the conclusion of interim contractor support. The USAF has developed five possible options for the MOD to consider (64; 65). The first option includes the construction of a separate facility with equipment and personnel dedicated solely to and funded entirely by the MOD. The second option calls for the construction of a single facility to be shared by multiple users. Each customer would pay for the staff and equipment

required to support their particular baseline configuration. The third option proposed involves shared support where a common facility, some personnel, and as much equipment as possible would be shared among users allowing for differences in configuration. The fourth option would allow all customers to share equipment and personnel in a separate facility. The fifth option would involve sharing the existing AISF facility with small increases in personnel and equipment to accommodate customer unique hardware differences. The exercise of either of the last two options is contingent on customers agreeing to a common baseline configuration. Under both options, customers would collectively determine their requirements and subsequently receive the same software releases.

The USAF wants to steer current and prospective E-3 customers toward choosing a standard software baseline and adopting the shared AISF option (52). While the USAF recognizes that some divergence from a standard baseline will be unavoidable due to differences in mission requirements and hardware configurations (for example, the UK's Maritime Scan-to-Scan processor), releasability policies, and the timing of modifications, there are several advantages to pursuing this course of action. First, system capabilities would be enhanced while interoperability is promoted. The need to separately analyze the impact of

proposed software changes against distinct configuration baselines would be eliminated. Separate testing and documentation would not be required. Secondly, customer costs are significantly reduced. Estimated costs of the five options discussed range from a high of about \$70 million (including both nonrecurring and recurring costs) for separate facilities for each customer to \$13 million for shared use of the existing AISF facility using a common baseline. Finally, a common baseline would facilitate the incorporation of future system modifications (64; 65).

Actual costs of any of the options would vary according to the number of customers availing themselves of the services. The greater the number of participating countries, the lower the cost for each customer. The USAF would benefit from the ability to share common equipment, conserve relatively scarce employee skills and exchange technical information.

The shared AISF option could be very attractive to prospective customers considering the reductions in defense budgets being experienced by our allies. Building, equipping, and staffing an indigenous software support capability might prove to be cost prohibitive with no guarantee that all required technical data necessary to perform the full range of services would be released (for example, Congressional restrictions have been imposed on

Saudi Arabia prohibiting them from maintaining their software in-kingdom). However, the choice of a common software baseline with shared support services, results in less responsiveness to unique customer requirements. The need for software changes must be supported by all the participating countries with work priorities assigned by mutual agreement. Additionally, the reliance on OC-ALC in providing support services fails to promote the transfer of technical knowledge related to avionics integration which could have beneficial economic applications in the civilian industrial sector of the customer country.

The support problem posed for OC-ALC in adequately planning AISF services is that it must receive firm commitments to the AISF from E-3 customers at the time of sale of the aircraft to ensure adequate support is available upon aircraft delivery (48:Sec 3.6.2.1). Additionally, purchasers should determine and freeze their software configuration baseline as soon as possible thereby permitting OC-ALC to properly scope the support requirements involved and initiate any procurement actions needed on a timely basis. As noted earlier, the existing AISF which is currently being shared by the USAF and NATO is saturated. The construction of additional facilities, plus the acquisition of required equipment and the recruitment and training of personnel to handle the added FMS workload would

take approximately four years to complete. However, if a common baseline can be agreed to and the existing facility shared, attainment of full support capability would be shortened to approximately 1 year depending on the availability of equipment to satisfy customer unique hardware configurations. Advance planning is crucial to providing effective support.

By law, U.S. monies can not be used to fund the project in anticipation of foreign investment. Consequently, customer commitments in the form of signed LOAs will be needed to provide the necessary funds. Considering the potential costs involved, however, some customers may be reluctant to commit themselves to the project unless other countries do likewise. The USAF will have to carefully market and coordinate the proposals among the prospective customers to ensure concerted country actions result.

The long-term picture for software support of the UK E-3 fleet is unclear at this point. The MOD has submitted a proposed software support plan which is being evaluated by the USAF. Questions regarding the releasability of technical data and source codes, however, still remain to be resolved. Notwithstanding the eventual outcome of these deliberations, the MOD will be dependent to some degree on interim contractor support for at least two years following initial aircraft delivery in 1991.

For its part, the USAF is taking a long-range, strategic approach to the whole matter. The USAF would clearly prefer the MOD (and other E-3 customers) to use the OC-ALC AISF for support. Interoperability of the worldwide E-3 fleet would be strengthened, the exchange of technical expertise and information among participating countries would be facilitated, and individual customer software support costs would be reduced. Whether an expanded AISF capability is ever established will largely depend on E-3 buy decisions presently pending in Italy, Japan, and Korea and subsequent determinations by those countries and other E-3 operators (UK, France and Saudi Arabia) to act in relative concert in agreeing first to a common configuration baseline and second to shared use of the OC-ALC facility.

Modifications. Since the introduction of the E-3 in the late 1970s, the USAF has pursued a continuous improvement program to stay abreast of the evolving threat and to incorporate new capabilities (48:Sec 5-1). Although no official policy has been established, the upgrade of foreign E-3s to maintain capabilities similar to USAF E-3s is generally considered to be in the best interests of the U.S. Such actions help to maintain comparable capabilities against common threats, promote interoperability, minimize

logistic and support requirements, and spread nonrecurring development costs.

Modifications are divided into two classes. Class IV modifications involve changes designed to correct performance deficiencies and to improve the reliability and maintainability of currently configured aircraft. E-3 Class IV modifications approved for USAF incorporation are managed by the E-3 SPM at OC-ALC. Class V modifications involve the introduction of new capabilities to the aircraft. E-3 Class V modifications are normally managed by the E-3 SPO at ESD consistent with program management direction issued by Headquarters USAF.

Responsibility for assessing the desirability and feasibility of incorporating Class IV modifications into the foreign E-3 fleet resides with the E-3 Technical Coordination Group. Proposed modifications are evaluated to determine the extent to which they satisfies operational requirements. The effectiveness of the evaluation process hinges on the creation and maintenance of well-defined configuration baseline. When a system's configuration is uncertain, modifications can not be undertaken until the system configuration is firmly established. This approach ensures that the proposed modification is compatible with the system in which it is to be installed.

The lack of a clearly defined configuration baseline for the UK's E-3 fleet will complicate the evaluation of potential Class IV modifications. Unique or uncertain component and equipment configurations will hinder system modification efforts. Changes may not be possible, delays may occur, and costs could rise to accommodate "unique" features of the UK configuration (72).

The root of the problem again lays with the nature of the Boeing contract which permits the substitution of best commercial practices for USG MILSPECs. This results in the use of some parts which are not readily identifiable to the DOD logistics system and may not be compatible with proposed modification efforts. To the extent that these unique items are involved, the E-3 TCG will have to expend additional time and research effort to ensure the compatibility and supportability of proposed modifications. To establish system compatibility, retrofit actions may prove to be necessary resulting in increased costs to the UK and delays in attaining enhanced mission capabilities.

The potential difficulties in evaluating and incorporating Class IV modifications would have been minimized if the UK had purchased the E-3 through FMS channels. The E-3 SPM would have been able to establish a configuration baseline against which all included and proposed modifications could be tracked and evaluated. When

the UK chose a direct commercial buy, however, this support capability was choked off due to lack of access to Boeing configuration baseline technical data.

Class V modifications represent major upgrades in system capabilities through the introduction of new technology and/or equipment. Pursuit of Class V modifications normally entail considerable investment in research and development funds with a protracted period involved from the point of program go ahead to actual production. Major Class V E-3 modification programs currently in development and available for foreign involvement or purchase are listed below with a brief description included for each:

1. Radar System Improvement Program (RSIP). Involves the upgrade of aircraft radar hardware components. The surveillance radar computer and surveillance radar control and maintenance console will be replaced. Radar sensitivity will be enhanced with improvements for radar performance control and maintenance incorporated.

2. Block 30/35 Upgrade or Integrated Contract (ICON) Program. This effort consists of four separate programs.

- a. Electronic Support Measures (ESM). Provides for a passive detection system capable of locating and identifying air, ship, and ground transmitters.

b. Joint Tactical Information Distribution System (JTIDS). Provides secure, jam resistant digital data and voice communications, relative navigation, and identification capabilities for real-time information distribution.

c. CC-2E Computer Memory Upgrade. Will increase the memory size of the E-3 main computer by a factor of four.

d. Global Positioning System (GPS). The GPS is a spaced-based navigation system designed to provide pinpoint time, velocity, and position data to land, sea, and air vehicles. Current program funding provides for the installation of on-board interfacing terminals on all E-3 aircraft.

3. HAVE QUICK A-Nets. Provides a limited jam resistant capability for air-to-air and air-to-ground voice communications.

To date, the UK has decided to include only the CC-2E memory upgrade and JTIDS portions of the Block 30/35 program and the HAVE QUICK A-nets in its E-3 configuration baseline. These systems are currently in the latter stages of full scale development/production with installation scheduled prior to first aircraft delivery in March 1991. Because of USAF funding shortfalls for the CC-2E and JTIDS programs, however, the production and installation schedule appeared

to be in jeopardy as late as the beginning of 1990. Insufficient funds were available to complete integration testing of JTIDS terminals prior to the need dates in the UK/ROF production schedule. Schedule slippage in completing testing of the JTIDS terminals would have resulted in either delays in the E-3 production schedule with concomitant contract cost penalties with Boeing or the acceptance of an aircraft system lacking the desired operational capabilities. To keep the programs on schedule, the MOD in conjunction with the ROF agreed in April to make good on the USAF funding shortfall by contributing \$17 million through FMS LOAs (61). It should be noted that this situation would have arisen even if the E-3 system sale had been conducted under FMS procedures. The matter is discussed here primarily to give the reader a better "feel" for the breadth of complex issues involved in supporting the transfer of the E-3 system.

Procurement of the ESM will not be required because the MOD is substituting the Loral 1017 ESM system (installed as wing-tip pods) which was originally procured for the canceled Nimrod AEW program. Consideration of GPS has been deferred.

As late as May 1990, "UK participation in RSIP is still being debated." (61) The MOD is interested in acquiring the system but was evaluating whether to join the USAF now

during the development phase or wait to buy off the shelf following production. The UK's preferred option was to join the program during full scale development which would ensure consideration of its operational requirements. By Headquarters USAF direction, however, the degree of MOD participation in the RSIP development effort would have been severely constrained (58). Although it would be co-funding the program, the MOD would not be granted direct input concerning system design nor would it be permitted access to various technology processes and data rights. The only real advantage to the MOD would be that its operational requirements would be considered during system design and the time needed to achieve system capability could be shortened by the additional funds provided for the development effort.

Over the long-term, any nation's decision not to upgrade to RSIP will significantly affect the USAF's ability to support the foreign E-3 fleet (48:Sec 5.6.1.6). As the USAF incorporates the RSIP into its E-3 configuration, major changes will occur in the logistics support infrastructure. Various radar support activities such as depot level maintenance, the AISF, training simulators, etc. will be upgraded with new RSIP components introduced into the supply system. As a consequence, countries choosing not to upgrade will have to develop separate hardware, software, and

training facilities and capabilities to maintain their currently configured radar systems.

The USAF is seeking from existing E-3 owners early commitments to the RSIP. Joint participation during the current full scale development phase of the program is being encouraged. Country participation now will spread research and development costs making the USAF's program needs less susceptible to the impacts of any Congressionally imposed budget cuts. The USAF has held preliminary discussions with NATO, the UK, the ROF and the RSAF. Detailed discussions concerning country requirements, time-phasing, cost sharing, and the transfer of technical data still remain ahead.

An initial UK decision to join the RSIP was initially deferred in 1989 due to MOD budgetary shortfalls. Assuming it could successfully address costs in its 1991 budget, the MOD submitted a request for price and availability in the fall of 1989. Before it would firmly commit itself, however, the MOD wanted to explore various technical issues, to understand what contractual arrangements would apply to a collaborative effort, and to discuss any required implementation documents such as LOAs and MOUs (84).

A response from the USAF was not immediately forthcoming. The USAF's delay in responding was attributed primarily to two factors. First, action was delayed while Headquarters USAF determined how MOD participation would be

accommodated (i.e. through FMS channels or cooperative procedures under Section 27 of the AECA). Secondly, the E-3 SPO could not readily respond due to the lack of manpower resources which "precluded the essential definition of a technical baseline." (61) To compensate for its manpower shortfall, the E-3 SPO recommended that the MOD fund a contractor conducted technical study through a FMS case at an estimated cost of \$500,000 (58). The MOD balked at this suggestion and have since withdrawn its P&A request opting instead to defer any further decisions until the RSIP is in production.

The events surrounding the UK's consideration of the RSIP points out an inherent deficiency in the DOD's support posture created by the UK's decision to acquire the E-3 through direct commercial sale, namely the lack of manpower resources. If the UK had purchased the E-3 through FMS procedures, the program LOA would have funded a program management staff at the E-3 SPO dedicated solely to the UK program. This staff would have been additive to the manpower authorized to perform USAF work at the SPO and would have been responsible for the overall day-to-day management of the program including the technical evaluation of system modification projects for possible inclusion in the UK aircraft. The program staff would have provided a

responsive focal point for UK inquiries ensuring full and timely consideration of UK concerns.

The LOA establishing the Acquisition Support Program provided some funding at the E-3 SPO to "coordinate/plan for future cooperative research and development/enhancements" but did not provide the level of resources needed to adequately respond to the complex questions now being raised by the MOD. Instead, the E-3 SPO has had to respond as best it can within currently constrained resources. With significant DOD budget cuts and personnel reductions looming on the immediate horizon, this situation is unlikely to improve without the influx of additional country funds through either FMS or cooperative program procedures. Under this scenario, additional USAF management attention can only be applied at the expense of other on-going USAF program efforts --- a delicate decision for USAF policy makers.

The Need for DOD Personnel Assistance

Although no DOD personnel will be required in the UK to assist in establishing an E-3 support infrastructure, the UK's need for DOD assistance has nonetheless grown during the course of the commercial sales program well beyond initial expectations. The full extent of the DOD's support role was not readily apparent at the time of the E-3 selection decision and subsequent signature of the Boeing contract. As subsequent events proved, the E-3 could not be acquired as a

purely commercial sale without substantial, continuous DOD involvement.

The DOD has been inextricably drawn into assuming greater responsibility for various facets of the program. Much of the DOD's expanded role has been born out of necessity stemming from the technically sensitive nature of the E-3, the degree to which the aircraft is dependent on USG owned resources, and the MOD's misperception regarding what services Boeing could provide vis-a-vis the USAF. The major support issues surrounding these considerations have been discussed earlier in this presentation and will not be repeated here in detail. Suffice it to say that DOD assistance was needed to ensure USG resources were timely acquired and scheduled to satisfy production line schedules, the transfer of technology was consistent with national disclosure policy, and all system support elements were properly integrated. The positive need for DOD assistance in ensuring program success has grown to the extent that all future E-3 sales will be conducted through FMS sales only. More will be said on this particular topic in the next chapter.

Contract Price

Comparative costs projected between FMS and direct commercial sale were a primary determinant in the MOD's

choice of acquisition method. What has been the result? Has the commercial contract proven to be a better value?

The two questions posed are not easily answered. As noted in Chapter IV, the P&A presented by the USAF was a best faith estimate. Actual cost would only have been determined following contract negotiations with Boeing. If history is any indicator, however, the actual FMS cost might have proven to be lower than the P&A estimate. To avoid problems associated with underestimated costs (for example, the time needed by foreign defense establishments to acquire supplemental funding), DOD personnel typically include a safety factor in their estimates to cover unanticipated rises in the cost of labor and raw materials. In support of this proposition, DOD studies have found that final FMS case costs fall on the average approximately 17 percent below original P&A estimates (27:11). While other factors may contribute to this outcome such as countries deciding to reduce LOA quantities, the results appear to be compelling considering the volume of FMS cases that have been concluded over the years.

Because the contract was signed relatively soon following the selection decision in November 1986, it appears that the cardinal points specification (CPS) was the MOD's primary, if not, sole criterion for contract award. However, it soon became apparent that the system priced by

the Boeing would not satisfy the MOD's total system requirement. Through further requirements definition, the MOD discovered that additional costs had to be incurred to meet total system needs. Accordingly, supplemental services were sought from Boeing through contractual changes (for example, assisting the MOD in determining the optimum mix of FMS, contractor, and in-service support for depot level maintenance) and the USAF through FMS LOAs (for example, establishment of the Acquisition Support Program). These actions added to the MOD's total program costs thereby narrowing the original disparity between the program estimates presented in the USAF's P&A and Boeing's tender offer.

There was speculation among USAF personnel at the time of the MOD's decision to pursue a commercial buy that Boeing might have purposefully overpriced the cost estimate it provided to the USAF P&A input in order to make the company's direct commercial offer more attractive (73). Just prior to the P&A presentation to the MOD in June 1986, Boeing informed the USAF that its cost input was valid only if a firm fixed-price (FFP) contract was used and would be even higher if a fixed-price incentive (FPI) contract was employed. The USAF subsequently learned that Boeing had priced its commercial tender somewhere between the FPI ceiling and the actual target.

Although the USAF did not rely solely on Boeing's input in structuring the P&A proposal, suspicion was raised whether Boeing was trying to "game the system" to its competitive advantage. At the root of the problem (if indeed it can be termed that) was DSAA's decision to permit concurrent consideration of FMS and commercial offers which gave Boeing a competitive edge in structuring a response to the USAF P&A and formulating its own commercial offer. As a result, the USAF was placed for all practical purposes in head to head competition with Boeing armed with different pricing groundrules and applying a divergent package development philosophy (i.e., the USAF priced a total system cost while Boeing priced strictly against the Cardinal Point Specifications).

Knowing the figure it had provided to the USAF would likely form a quasi-baseline cost for the USAF's P&A price, Boeing could structure its commercial proposal accordingly. Boeing had several options at its disposal including the pricing of a minimum system and negotiating the total system after contract signature, pricing low to keep the production line open and thereby minimize costs in anticipation of additional customers in the future, and simply undercutting all other offers (including FMS) augmented by an attractive offsets package.

In developing its P&A estimate, the USAF used a total package approach which was based on the UK CPS, the UK operational requirement (as understood by the USAF), and previous experience working with Boeing. The package included all support elements the USAF believed necessary to effectively introduce the E-3 into RAF service. Accordingly, the USAF proposal encompassed a number of services that were not included in the Boeing offer, therefore, raising its relative price. For example, the USAF offered a full range of design support services including participation in the E-3 Technical Coordination Program and the Aircraft Structural Integrity Program. Total estimated cost of these services was \$12 million. (Note: Under normal circumstances, these services would have been priced as a separate P&A because they represent follow-on support activities which are not included in a system sale LOA. Cost figures were provided in accordance with the UK request for tender.)

Additionally, the P&A included a line for USAF management services which was added by the USAF to the UK's list of requirements. Estimated cost of providing these services was around \$39 million. Based on subsequent events, it did not appear that the MOD fully understood what those services entailed. At first glance, the services may have been viewed as somewhat redundant to the DOD support

infrastructure that would be funded by the three percent administrative surcharge applied to the program. In point of fact, however, these management services would have provided a variety of engineering, technical, and program management support activities over and above the general case administration functions funded by three percent surcharge monies. Besides providing a staff to plan, schedule, direct and control the acquisition program (functions which were included in the Boeing offer), USAF management services would have provided personnel to perform spares analysis, evaluate engineering change proposals, assess the need for and supportability of system enhancements, determine interoperability requirements, perform system integration evaluations, assist in determining long-term support requirements, etc. A relatively minor portion of these services was subsequently provided through the Acquisition Support Program under a separate LOA.

It is possible that what the USAF management services would provide was not thoroughly explained to the MOD. The P&A merely identifies the USAF organizations involved (e.g., HQ USAF, AFLC, AFSC, etc.) noting that the manpower included direct charge personnel only.

Bound by relatively inflexible pricing and package structuring guidelines, the USAF's P&A proposal was

virtually doomed to finish a poor second to Boeing's commercial offer. On the surface, Boeing's commercial offer had more going for it --- better price, quicker delivery, and the opportunity for direct MOD involvement in program management. What the MOD appears not to have fully realized at the time was the "hidden costs" contained in the Boeing offer (i.e. what the contract did not include but was needed) and what the FMS P&A included but was not properly appreciated (i.e. the program management expertise possessed by the USAF) (80).

Delivery Schedule

As noted in Chapter IV, there did not appear to be much difference between the delivery schedule estimated in the FMS P&A and that offered in Boeing's commercial offer. The distinction that existed between the two proposals rested with the assumptions used in their development.

Procurement leadtime would have been considerably less under a commercial sale versus FMS. Having strictly complied with the MOD's cardinal points specification in structuring its tender offer, Boeing anticipated a relatively short lapse of time till contract award. This in fact happened as the contract between the MOD and Boeing was signed less than three months following the MOD's selection decision. At that point, Boeing was locked into a specific delivery schedule according to the terms of the firm fixed-

price contract. Any delays occurring in meeting the schedule would be at Boeing's expense unless they involved circumstances beyond Boeing's control (for example, changes in USG regulatory requirements, employee strikes, etc.)

(77:Clause 11).

With a firm delivery schedule in hand early on, the MOD could immediately begin planning for needed phased-in support with a high degree of confidence regarding the timing of required actions. Although the MOD has encountered problems with contractual coverage and execution in some areas, Boeing's adherence to the aircraft delivery schedule has not been one of them. Except for a three month slippage caused by an employee strike in 1989, Boeing has been able to meet the contracted delivery schedule.

The FMS projected delivery schedule was predicated on a 1 January 1987 contractor start date with full contract award occurring by 1 September 1987. Contrary to the likely timing prospects for a commercial contract, awarding a contract under FMS procedures promised to be a relatively protracted process. For FMS purchases, the DOD uses the same procurement procedures in acquiring goods and services that it uses for its own purchases. In the case of a major weapon system acquisition, contract award would not have occurred until several months of definition and fact finding had first been conducted.

The P&A projected a rather optimistic contract negotiation schedule with full contract award occurring within 12 months of LOA signature. In reality, the contract would have probably taken at least 18 months to award (79). Such a contracting timetable would have pushed back the aircraft delivery schedule estimated in the P&A by a minimum of six to twelve months thus making it less attractive than that available under a commercial contract. Additionally, the more protracted nature of the contract negotiations would have imposed greater uncertainty in the MOD's support planning activities.

Contracting Flexibility

Although by no means the sole factor, the ability to quickly negotiate an offset arrangement with Boeing was a significant consideration in MOD's decision to purchase the E-3 through a direct commercial contract. The offset provisions promised to benefit UK industry through the inflow of high technology work and the sustainment of employment levels.

What impacts did the offset arrangement have on the U.S.? In total, the results appear to be rather unclear. There was no readily apparent adverse impact on either Boeing or the DOD. For Boeing, the UK sale meant that the E-3 production line would remain open with the retention of 2,000 employees who otherwise would have had to be

reassigned to other projects (68). By forgoing production start-up costs downstream, Boeing would be in a more advantageous position to offer competitive bids for any future AEW sales. Additionally, Boeing's ability to retain its E-3 team meant that the company could offer the DOD lower prices on the various E-3 upgrade programs being pursued by the DOD for which Boeing was the prime contractor.

If any adverse impacts were occurring, they were probably centered on the sub-tier contractor level of the U.S. industrial base. To satisfy its offset commitments, Boeing had to transfer a portion of its subcontracting work to UK firms that otherwise might have been placed with U.S. firms. Viewed from that vantage point, the offset might have cost U.S. jobs and resulted in the transfer of manufacturing technology and the development or strengthening of foreign competition. Conversely, Boeing might have lost the AEW competition had it not agreed to the offset arrangement. In that case, half a loaf might truly have been better than no loaf at all. No U.S. firms would have benefited regardless of their placement within the industrial base.

Notwithstanding its official hands-off policy concerning the negotiation and fulfillment of offset agreements, the DOD needs to watch very carefully what is

happening at the lower tier or basic maunfacturing level within the defense industry. In many instances, the DOD has become dependent on either U.S. sole source vendors or off-shore suppliers for vital military components (57:4). This situation is perhaps acceptable as long as an uninterrupted supply of quality components can be maintained at a reasonable price. However, the ability to at least dual source many items appears to be desireable not only to promote competition and product availability but to improve mobilization capability as well (49:17). A continued rise in offsets may very well inhibit the DOD's ability to achieve this objective.

VI. Discussion and Recommendations

Discussion

The intent of this thesis was to explore the various issues that can confront the DOD in supporting the transfer of a major weapon system through a direct commercial sale arrangement. In pursuing this objective, a case study of the UK E-3 direct commercial sale program was conducted to identify and highlight some of the support and policy issues that can arise. To lay the foundation for the analysis effort, the following three basic investigative questions were posed:

1. What factors were considered by the UK in deciding whether to purchase the E-3 through direct commercial sale versus acquiring the system through FMS?
2. From the UK's standpoint, what were the perceived advantages and disadvantages of direct commercial sales versus FMS?
3. What policy issues arose and what problems were confronted by the DOD in supporting the transfer of the E-3 system to the UK through direct commercial sale?

Information germane to the investigative questions was collected and evaluated against the major issues that purchasing countries should consider in making a choice between FMS and direct commercial sale in attaining a major weapon system. Specific (although by no means exhaustive)

areas of support activities and relationships were analyzed and various findings reported. The paragraphs that follow summarize the results of the investigation, identify lessons learned, recommend or comment on future DOD support plans and policies, and suggest areas for additional study.

Summary Results

For the UK, its decision in late 1986 to acquire the E-3 through a direct commercial arrangement culminated a distinct trend away from purchasing U.S. arms through FMS procedures. The UK decision also coincided with the general rise in the level of direct commercial sales as a percentage of total U.S. military sales exports.

In making its choice between direct commercial sale and FMS, the UK weighed heavily considerations of comparative price, delivery schedule, and contracting flexibility. The direct commercial sale route looked more attractive in all three categories. Under a commercial buy, the price was lower and assured, the delivery schedule appeared to be more responsive, offset arrangements were more easily consummated, and direct MOD contractual involvement with Boeing was provided. The UK's overall perception of the relative merits of the two acquisition methods was in consonance with the prevailing viewpoint shared by many other countries at the time (53:58).

In addition to believing a direct commercial arrangement offered a better deal, the UK MOD was confident that it had the necessary skilled and experienced personnel resources and contractual/obligational instruments available and in place to effectively manage the acquisition effort. In the Procurement Executive Office, the MOD had a highly professional purchasing staff which was familiar with U.S. contracting laws and had previous experience dealing with Boeing on another major defense program, the CH-47 Chinook helicopter. This core contracting staff was augmented by MOD liaison personnel located at Boeing's Seattle facilities and the E-3 SPM office at OC-ALC who facilitated the flow of information and data among the MOD, Boeing, and the USAF. A direct commercial sale also allowed the MOD immediate access to Boeing thereby bypassing the USAF who would have been the purveyor of MOD requirements under FMS procedures.

To ensure any negative effects stemming from unforeseen gaps in contract coverage would be minimized, the MOD signed a MOU with the DOD that was expected to cover any shortfalls in Boeing support and eliminate general policy and administrative obstacles that might otherwise impede the program. With the MOU in hand, the MOD was confident of DOD's full assistance including the transfer of technical data necessary for the "introduction into service.

operation, and through life support" of the UK E-3 fleet (29; 80).

For the U.S., the UK's decision to buy the E-3 commercially was in keeping with the DOD's stated policy of having no preference whether a country chooses FMS or direct commercial sale in satisfying its defense needs. The UK E-3 sale followed closely on the heels of other commercially delivered programs (such as the F-18 sale to Canada) which, although certain difficulties were encountered, were generally regarded as successful ventures.

Lessons Learned

The UK E-3 program has pointed out the crucial role that advance planning and detailed discussions between the DOD and a purchasing country can have on the ultimate success or failure of a arms transfer program. Additionally, the importance of conducting these activities prior to the consummation of a sale increases proportionately with the complexity and sensitivity of the system involved. The rapidity at which the Boeing contract and the MOU were signed following the MOD's selection decision precluded the holding of in-depth discussions with the various USAF support activities involved prior to program start. Consequently, numerous policy issues and support problems were left to be discovered later that

resulted in potential program delays, embarrassment for the USAF, and a diminution of DOD credibility.

Before selection decisions are finalized, country requirements should be well-defined and the DOD's and/or a contractor's ability to satisfy those needs should be clearly understood. In this way, a purchasing country can compare and contrast the relative advantages of the two acquisition methods and make a fully informed decision given the particular circumstances involved. In the UK E-3 program, contractual commitments were made regarding USAF support in a number of areas (for example, provision of GFE, attaining authority for use of special assets, etc.) without the benefit of input from those USAF activities assigned responsibility for accomplishing the tasks. Also, the various supporting USAF organizations were given a minimum of time to review and comment on the proposed MOU with relatively little opportunity to discuss any concerns directly with the MOD. Under this scenario, it was virtually inevitable that delays or difficulties in DOD task accomplishment would occur with accompanying loss of credibility in the eyes of the purchaser.

Data disclosure probably was the single, most nettlesome issue to arise during the UK program. What technical data will or will not be released and at what cost should be clearly defined up front and not left to discovery

at mid-program. The MOD firmly believed that pertinent sections of the Boeing contract and the MOU ensured the transfer of technical data needed to properly absorb and independently maintain their E-3 fleet. That the documents did not, in fact, guarantee the type of support expected by the MOD became the topic of frequent high level discussions and recriminations among MOD, USAF, and Boeing officials. Many of those concerns could have been avoided at the program's outset had the DOD's disclosure policy toward the UK been fully explained in respect to the specific items of technology in contention.

After a weapon system has been delivered, many countries which possess the requisite contracting skills and supporting logistics infrastructure find it advantageous to procure various bits and pieces of follow-on supply directly from U.S. contractors. The purchase of a major weapon system replete with all necessary support elements, on the other hand, takes a degree of program management experience and system integration expertise that most countries and many U.S. prime contractors lack but which the USAF can best provide. The accuracy of this claim, of course, depends in large measure on several factors including the sophistication and sensitivity of the weapon system, the system's maturity and configuration stability, and the

degree to which the system's components are owned by the USG. The UK E-3 program has been a case in point.

A significant portion of the E-3 system and supporting elements are owned by the DOD perhaps to a degree greater than exists in any other system currently available for transfer. This fact combined with the assessed sensitivity of the system technology involved and experience gained through the UK/ROF program has convinced the DOD that commercial sales of the E-3 in the future are neither practical nor desireable. In accordance with Section 38(a)(3) of the AECA, therefore, the Director of DSAA has determined that all future E-3 sales will be conducted through FMS channels (48:Sec 4). All prospective buyers have been so informed

Conduct of the UK E-3 program suffered from the lack of a well-defined USAF organizational structure. Questions arose at the beginning regarding program management leadership, appropriate routing of country inquiries and responses, procedures for reviewing proposed disclosures of technical data, etc. Many of these issues were not resolved until over one year into the program. To maximize the effectiveness of its support activities for any future E-3 sales, therefore, the USAF should establish clear-cut lines of authority, communication and responsibility at the outset

of a program. In this way, duplication of management effort can be avoided, processing functions can be streamlined, and debilitating "turf warfare" can be eliminated.

Future Plans

With delivery of the UK/ROF order, Boeing's 707/E-3 production line will close in May 1991. As mentioned before, Italy, Japan, and Korea are actively interested in purchasing the E-3 at the present time. The USAF is attempting to coordinate the countries' deliberations and attain a joint purchase commitment by the end of 1990 (52). Without firm commitments from the countries by that time, the gap in Boeing's production line will become cost prohibitive to bridge. The requirements of any one of the countries will not be sufficient by itself to sustain economical production operation.

The USAF's proactive approach appears to be sound. A multitude of benefits will accrue to the USAF from additional foreign purchases of the E-3. First and foremost, worldwide AEW interoperability will be enhanced among U.S. allies resulting in increased mission effectiveness. Secondly, individual country operating costs can be minimized through the pooling of common resources (for example, support equipment, maintenance facilities, training, etc.). In an era of declining defense budgets, this feature could be

particularly appealing. Finally, system upgrade costs can be distributed across a broader base.

Recommendations for Additional Study

It is difficult, if not impossible, to extrapolate the results of the UK E-3 case study to the general issue of the relative advantages and disadvantages of FMS versus commercial sale. Application of the results to proposed sales of other weapon systems to different countries would not be appropriate. The UK/ROF E-3 sale was unique from the standpoint that it has been the only commercial sale of the E-3. Additionally, the E-3 may be the most complex and sensitive aircraft weapon system available for military export today. What is clearly revealed, however, is the validity of the cautionary note contained in the DSAA brochure that a country's decision in choosing between FMS and commercial sale will be largely grounded on circumstances peculiar to that country and the defense articles or services being acquired. The UK program serves to highlight many of the considerations faced by countries in making a choice between FMS and direct commercial sale and the possible ramifications of the selected course of action.

Research into other commercially delivered major weapon systems would help to build the total body of knowledge available regarding the myriad of issues involved in a

purchasing country's decision and the DOD 's ability to support that choice. Each program would lend its own unique flavor. Two programs come immediately to mind, the F-18 sale to Canada and F-16 sale to Greece. The Canadian program in particular enjoys the advantage of having completed system delivery with transition into follow-on support status. Unlike the UK E-3 program where some delivery and activation events are still in the process of unfolding with final results yet unclear, the Canadian program would provide a researcher with more finite outcomes to document and analyze.

Appendix A: Glossary of Selected Terms

Accessorial Cost - The value of expenses incidental to issues, sales, and transfers of materiel which are not included in the standard price or contract cost of material; also any expenses incidental to the performance of services, training, etc.

Administrative Cost - The value of costs associated with the administration of FMS. The prescribed administrative percentage for a case appears in the DD Form 1513, Letter of Offer and Acceptance. This percentage is applied against the case. Expenses charged directly to the FMS case are not included.

Arms Transfers - Defense articles and defense services, such as arms, ammunition, and implements of war, including components thereof, and the training, manufacturing licenses, technical assistance and technical data related thereto, provided by the U.S. government under the Foreign Assistance Act of 1961, as amended; other statutory authority; or directly by commercial firms to foreign countries, foreign private firms, or to international organizations. [Executive Order No. 10973, as amended, Administration of Foreign Assistance and Related Functions.]

Case - A contractual sales agreement between the U.S. and an eligible foreign country or international organization documented by a DD Form 1513, Offer and Acceptance.

Commercial Sale - Sale made by U.S. industry directly to a foreign buyer which is not administered by the DOD through FMS procedures.

Cooperative Logistics Supply Support Arrangements (CLSSA) -

CLSSAs are peacetime military logistics support arrangements designed to provide responsive and continuous supply support at the depot level for U.S.-made military materiel possessed by foreign countries and international organizations. The CLSSA is normally the most effective means for providing common repair parts and secondary item support for equipment of U.S. origin which is in allied and friendly country inventories. [Security Assistance Management Manual, Ch. 7]

Cooperative Projects - Jointly managed arrangements between the U.S. and a NATO member country (or countries) or a specific non-NATO country (or countries). These projects, which must be described in a written agreement, provide for the cooperative sharing of the costs of research, development, testing, evaluation, or joint production (including follow-on support) of specific defense articles. With NATO member countries, these projects are designed to further the objectives of standardization, rationalization,

and interoperability (RSI). Similar projects with non-NATO member countries serve to enhance the ongoing multinational effort of the participants to improve their conventional defense capabilities. Waivers or reduction of FMS charges (e.g., non-recurring cost recoupment charges, asset use charges and administrative charges are authorized for such projects since they are not normally implemented through the FMS system. [Section 27, AECA]

Defense Articles - Includes any weapons, weapons system, munitions, aircraft, vessel, boat, or other implement of war; any property, installation, commodity, material, equipment, supply, or goods used for the purposes of furnishing military assistance or making military sales; any machinery, facility, tool, material, supply, or other item necessary for the manufacture, production, processing, repair, servicing, storage, construction, transportation, operation, or use of any other defense article or any component or part of any articles listed above, but shall not include merchant vessels, major combatant vessels, or as defined by the Atomic Energy Act of 1954, as amended, source material, by-product material, special nuclear material, production facilities, or atomic weapons or articles involving restricted data. [Section 644(d), FAA and Section 47(3), AECA]

Disclosure Authorization - Authorization by appropriate MILDEP authority which is required prior to disclosure of classified information to foreign nationals who are cleared by their government to have access to classified information.

Foreign Liaison Officer (FLO) - An official representative, either military or civilian, of a foreign government or international organization stationed in the United States normally for the purpose of managing or monitoring security assistance programs.

Foreign Military Sales (FMS) - That portion of United States security assistance authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act, as amended. This assistance differs from the Military Assistance Program and the International Military Education and Training Program in that the recipient provides reimbursement for defense articles and services transferred. FMS includes DOD cash sales from stocks (inventories, services, training); DOD guarantees covering financing by private or Federal Financing Bank sources for credit sales of defense articles and defense services; sales financed by appropriated direct credits; and sales funded by grants under the Military Assistance Program.

Letter of Offer and Acceptance (LOA) - U.S. Department of Defense (DD) Form 1513 Offer and Acceptance by which the

U.S. Government offers to sell to a foreign government or international organization defense articles and defense services pursuant to the Arms Export Control Act, as amended. The DD Form 1513 lists the items and/or services, estimated costs, the terms and conditions of sale, and provides for the foreign government's signature to indicate acceptance.

Memoranda of Understanding (MOU) - Principal means of promoting standardization within military alliances, through cooperative action. MOUs are intended to encourage bilateral arms cooperation and trade; establish regular review of armaments programs and trade; and make efficient use of resources through expanded competition. DOD enters into reciprocal defense procurement and offset agreements with NATO, individual NATO governments, and other friendly governments to purchase and sell defense equipment and logistics support. MOU objectives may be of a general nature to provide for waiver of "Buy National" restrictions; promote greater cooperation in research, development, production, and procurement to enhance standardization and interoperability; and provide guidance on supplemental specific MOUs.

Military Export Sales - All sales of defense articles and defense services made from U.S. sources to foreign governments, foreign private firms and international

organizations, whether made by DOD or by U.S. industry directly to a foreign buyer. Such sales fall into two major categories; foreign military sales and commercial sales.

National Disclosure Policy - Provides that classified military information is a national security asset which must be conserved and protected, and which may be shared with foreign governments and international organizations only where there is a clearly defined advantage to the U.S. The basic disclosure policy was issued in 1971 by the National Security Council with Presidential approval. Under the policy, the Secretaries of State and Defense are jointly responsible for controlling the disclosure of classified military information to foreign entities.

Offsets - Refers to a usage of industrial and commercial compensation as a condition of sale for military-related exports (i.e., either FMS or commercial sales of defense articles and defense services).

Direct Offsets - Permits a foreign country to produce in-country certain components or subsystems of a weapon system it is buying from a U.S. supplier as a condition of the sale.

Indirect Offsets - Involves goods unrelated to the defense item sold. The supplier agrees to purchase a certain dollar value of the buyer's manufactured products.

raw materials, or services as a condition of the sale, usually over an extended, open-ended period.

Price and Availability (P&A) Data - Estimate of price and availability of defense articles and services of sufficient accuracy to be used for the preparation of an LOA. P&A data provided separately from a LOA does not constitute a commitment by the U.S. Government to offer for sale the articles or services for which the estimate was prepared.

Security Assistance - Group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense related services, by grant, credit or cash sales, in furtherance of national policies and objectives. [JCS Pub 1]

Services - Services include any service, test, inspection, repair, training, publication, technical or other assistance, of defense information used for the purposes of furnishing non-military assistance under the Foreign Assistance Act of 1961, as amended, or for making military sales under the U.S. Arms Export Control Act of 1976, as amended.

Technology Transfer - The process of transferring , from the industry in one country to another or between countries.

technical information relating to the design, engineering, manufacturing and production techniques for hardware systems using recorded or documented information of a scientific or technical nature. It normally does not include the transfer of common reference documentation such as military standards, specifications, handbooks or commercial counterparts to these documents.

Third World - Refers to those countries with under-developed but growing economies, often with colonial pasts, and low per capita incomes. Third World is often used interchangeably with or as a synonym for "LDC's" (less developed countries), "the South," "the Group of 77," "developing countries," or "underdeveloped countries." [International Relations Dictionary, Department of State Library, 1978]

Total Package Approach - A means of ensuring that FMS customers are aware of and are given the chance to plan for and obtain needed support items, training, and services required to introduce and sustain the operation of major items of equipment or systems.

Appendix B: Abbreviations and Acronyms

AECA	Arms Export Control Act of 1976
AEW	Airborne Early Warning
AFLC	Air Force Logistics Command
AFPRO	Air Force Plant Representative Office
AFSC	Air Force Systems Command
AISF	Avionics Integration Support Facility
ALC	Air Logistics Center
ASG	Acquisition Support Group
ASP	Acquisition Support Program
AWACS	Airborne Warning and Control System
CLSSA	Cooperative Logistics Supply Support Arrangement
COMSEC	Communications Security
DA	Design Authority
DCAS	Defense Contract Administration Service
DLA	Defense Logistics Agency
DLM	Depot Level Maintenance
DOD	Department of Defense
DSAA	Defense Security Assistance Agency
ECM	Electronic Counter-Measures
ECP	Engineering Change Proposal
ESD	Electronics Systems Division
ESM	Electronic Warfare Support Measures
FAA	Foreign Assistance Act of 1961
FLO	Foreign Liaison Officer

FMS	Foreign Military Sales
FSD	Full scale development
GAO	General Accounting Office
GFE/GFM	Government Furnished Equipment/Government Furnished Material
GPS	Global Positioning System
JAFMO	Joint Anglo-French Management Office
LOA	Letter of Offer and Acceptance
MILSPEC	Military Specification
MOD	Ministry of Defence (United Kingdom)
MOU	Memorandum of Understanding
NATO	North Atlantic Treaty Organization
OC-ALC	Oklahoma City Air Logistics Center
OMB	Office of Management and Budget
P&A	Price and Availability
PDS	Post Design Services
RAF	Royal Air Force (United Kingdom)
ROF	Republic of France
ROM	Rough order of magnitude
RSAF	Royal Saudi Air Force
RSIP	Radar System Improvement Program
SPM	System Program Manager (AFLC)
SPO	System Program Office (AFSC)
TCG	Technical Coordination Group
TCP	Technical Coordination Program
UK	United Kingdom
USAF	United States Air Force

U.S. United States

USG United States Government

Appendix C: Definition of Offset Elements

Although the terms of the offset on individual contracts may vary substantially and a contract may call for more than one kind of offset, offsets can generally be grouped into the following types:

Coproduction - Overseas production based upon government-to-government agreement that permits a foreign government or producer to acquire the technical information and know-how to manufacture all or part of an item of U.S. equipment. It includes government-to-government licensed production. It excludes licensed production based upon direct commercial arrangements by U.S. manufacturers.

Licensed Production - Overseas production of all or part of an item of U.S. equipment based upon transfer of technical information and know-how under direct commercial arrangements between a U.S. manufacturer and a foreign government or producer.

Subcontractor Production - Overseas production of a part or an item of U.S. equipment. The subcontract does not involve license of technical information or know-how and is usually a direct commercial arrangement between the U.S. manufacturer and a foreign producer.

Overseas Investment - Investment arising from the offset agreement, taking the form of capital invested to establish

or expand a subsidiary or joint venture in the foreign producer.

Technology Transfer (other than licensed production and coproduction) - Transfer of technology occurring as a result of an offset agreement that may take the form of:

1. Research and development conducted abroad.
2. Technical assistance provided to the subsidiary or joint venture of overseas investment (see above).
3. Other activities under direct commercial arrangement between the U.S. manufacturer and a foreign entity.

Countertrade - Purchase of goods and services from the buyer country as a condition of the offset agreement, excluding purchases under coproduction or licensed or subcontractor production. These purchases may be made by the U.S. government, the U.S. contractor, the contractor's suppliers, or by third parties with whom the contractor acts as a middleman. The purchase may involve products for defense or civil use.

Source: Department of the Treasury and Aerospace and Electronic Industries Association Survey, dated May 24, 1983.

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<p>This study explored the considerations underlying a foreign country's choice between Foreign Military Sales and commercial sale in acquiring a major weapon system and, in the process, identified various issues and problems that can confront the DOD in supporting a commercial sale.</p> <p>A case study of the commercial sale of the E-3 to the United Kingdom was employed to investigate the proposition that there are advantages and disadvantages to each acquisition approach.</p> <p>The Defense Security Assistance Agency's brochure, "A comparison of Direct Commercial Sales & Foreign Military Sales for the Acquisition of U.S. Defense Articles and Services" was used as a backdrop in analyzing the UK E-3 sale. Six specific considerations were evaluated including (1) the ability to negotiate and administer a contract, (2) logistics and training needs, (3) the need for DOD personnel assistance, (4) contract price, (5) delivery schedule, and (6) the need for contacting flexibility.</p> <p>The study revealed that comparative price, delivery schedule, and contracting flexibility were primary considerations in the UK's decision to acquire the E-3 through direct commercial sale. However, the study also revealed numerous drawbacks that the arrangement had for both the UK and the DOD. Finally, the study provided valuable lessons learned which can be applied to future sales of the E-3.</p>		
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